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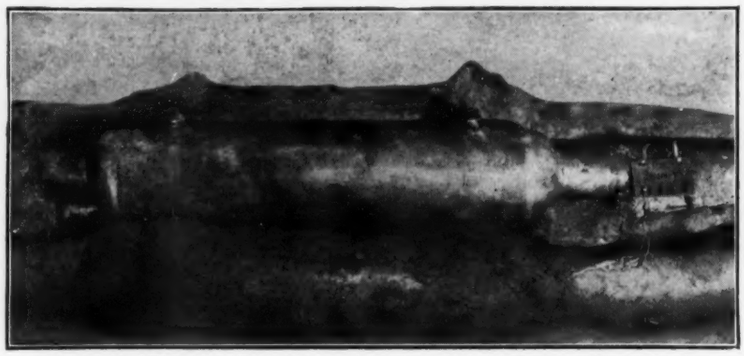

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Electrical World

Published by McGraw-Hill Publishing Company, Inc.
W. H. ONKEN, JR.
Editor

VOLUME 87 — *New York, Saturday, May 29, 1926* — NUMBER 22

"What's Wrong with This Picture?"

IN LARGE organizations the fear of censure outweighs the thirst for praise. Perhaps this is because censure is sure, swift and vociferous. Censure hits the deserving like a ton of brick, while praise, if any, often misses the mark. Perhaps this is the reason; at any rate, it is a fact that many central-station activities, and especially those carried on in the commercial departments, are guided more by fear than by hope. A sales plan, a merchandising opportunity, is offered. There is no enthusiasm. The utility's commercial man gazes upon the proposition with a fishy eye. He picks it apart, looking for flaws. He calls in his helpers and asks their advice: "What's wrong with this picture?"

We venture the opinion that very little commercial progress is made that way. The essence of success is faith, confidence, optimism. Enthusiasm and an unconquerable will to win are the chief factors in every constructive activity. Unquenchable optimism and determination have been conspicuous characteristics of all great leaders of successful campaigns, from Alexander to Gates, whether in battle, politics or business. They feared sins of omission more than they feared sins of commission and their successes justified this attitude. The physical and financial structures of the electrical industry were, and are being, built by such men and the same spirit can animate electrical merchandising.

The Range Is Vindicated

AFTER three years' extensive engineering investigation and analysis the N. E. L. A. domestic cooking and water-heating committee has completed its report upon the electric range. It found favorably for this appliance as a load and revenue builder for the power companies, and the report shows that the electric range demand upon the system, instead of materially increasing investment and peak load, has many desirable characteristics which can be utilized to improve the diversity and load factor of residential circuits. The committee is to be congratulated upon the thoroughness of its work and should be particularly commended for its perseverance despite the many obstacles encountered. The range as a load has been vindicated, and now that the stigma of undesirability has been removed, it will be possible for power companies to go ahead with definite sales programs for obtaining this business. Its addition will be felt in substantially increased domestic revenue.

There is but one fly in the ointment. Ten years ago at the N. E. L. A. convention in Chicago a few daring souls seriously proposed the electric range to the central-station industry as a load and revenue builder. It aroused then a certain degree of polite interest in some quarters, but the "more conservative ones" soon found what they considered enough negative elements to warrant the conclusion that the range load was expensive, undesirable and unprofitable. It has taken ten years to down that popular misconception, which, at best, was based, not on fact, but on opinion. Ten years! Not exactly wasted, but how much revenue would the central-station companies now be receiving from this load if they had gone ahead and taken the business? Suppose it had taken that long to decide whether the lighting or motor load was profitable! The delay should serve well as an object lesson. All business is good business. If existing rates are not suited to taking on certain loads, they can and should be adjusted to meet conditions. It is always possible to find the economic balance where the rate for service will be mutually profitable to the utility and the customer.

The Future of Cost Allocations

SOMETHING more than statistics of the obvious variety must be applied to public utility affairs from now on if managers are to measure up to the newer standards of administration so rapidly coming to the front. These standards require among other qualities the ability to conduct and interpret searching economic investigations in all sorts of problems. "Sharp-shooting" accountants with wide knowledge of company affairs are needed on the firing lines of such inquiries, and just as the engineers prepared and maintained the way for the infantry and artillery in the zone of combat during the World War, so must the technical staffs of the utility industry lead the way in that great assault upon inadequacy of information, cost allocation.

In private reports many operating companies have had the benefit of cost-allocating skill for a good while, but on the whole such services have been called into action occasionally rather than regularly. Very able judgment is demanded in this work. In large groups of companies under centralized management this grade of ability can be maintained as a staff resource, and the same thing is true today among a few large single companies. What is now needed is the regular and general practice of this absorbing and extremely useful specialty, not of course on a scale too sweeping to accomplish definite tasks, but along lines calculated to bring out the hidden meanings of routine data and of information that are baffling to assemble and none too easy to interpret.

The ability is needed to determine far more quickly the essential data bearing upon the cost of handling different classes of service, for example. To some managers this problem looks hopeless at the start, and they run to cover with the advice to seize all the business in sight regardless of its cost, trusting to fate, perhaps, that net earnings will not in their time be jeopardized by improvident contracts or inadequate rates. If there is any harder task in the utility industry than changing unprofitable contracts into profitable ones, let it be cited! If there is any more desirable work in this stage of utility development than a systematic organization of cost allocation methods and practice, let it be called forth!

The days when investors and higher executives will rest content with the report that cost allocations are not available because the basic information is not and

has not been accessible even to skillful economic diagnosticians are fast departing. The whole scheme of estimating must be put on a more scientific plane, and willingness to spend money liberally for recording instruments, to carry on patient, often tedious and long-drawn-out studies in typical territory, and to conduct these studies with the hard-working co-operation of as many staff members as can contribute to the advance must be beyond question. Shall the industry be balked by such a fact as the supply of several classes of loads from a single feeder in its effort to determine the overhead allowance to be made for residence service as against local power or commercial lighting? Shall the mere fact that a substantial interconnection may throw investment cost allocations gathered in the old independent company statistical régime into the discard discourage managers from attempts to separate local from intercompany fixed charges? The answer must be unanimously "No" among all progressive utility key men and leaders, for the economic "dare" is too great to be overlooked or turned down by the kind of central-station men who will be fit to head their companies in the wonderfully interesting days and nights now so close upon the electrical world.

Basis for Comparing Draft Tubes Needed

INASMUCH as the selection of hydraulic turbines and draft tubes should be based on comparisons of performance, and since a proper basis of comparison is now lacking, some means of comparison should be provided in the power test code of the American Society of Mechanical Engineers, which is about to be revised. A recommendation to this effect has been made by the hydraulic power committee of the N.E.L.A., in which it suggests that a standard model draft tube be used as the basis of comparison.

Considerable discussion has occurred as to what form the specifications of such a standard should take. The principal question is whether such a standard tube can properly be a homologous tube with fixed proportions, the size depending on the throat diameter, or whether there should be what might be called a family of standard tubes depending on the specific speed, test head, runner design, etc.

The difference in opinion is evidently due to difference of purpose and not difference of judgment. One side of the argument is based on comparing draft tubes only and the other on comparing the combined waterwheel and draft tube. For the former purpose it appears that a standard model tube might be used as a basis of comparison. For the latter purpose no one is ready to suggest the answer, since a diffuser which is best for one wheel may not be best for another wheel even of the same specific speed. There is a very definite relation between desirable length, flare, diameter of throat and velocity of water.

For comparing draft tubes alone the standard of comparison need not be the most efficient; it should be simple and not erratic in performance. A straight, conical tube might serve. Compared on this basis for a given head, tested draft tubes might rank for excellence of performance in one order for a given ratio of whirl of water (corresponding to runner discharge) to velocity of discharge and in another order for a different ratio of whirl. Still different orders of performance would be established for different heads. The foregoing test would not indicate that one draft tube is always best but that a certain design excels for a given head and ratio of whirl corresponding to a given runner under a given load.

At present all the careful draft tube tests are incomparable for lack of a common basis. If hydraulic power equipment users want a basis for comparison that will eliminate the present guesswork or costly investigations, they will co-operate with the N.E.L.A. hydraulic power committee and the A.S.M.E. sub-committee on draft tubes.

Lightning as an Electronic Phenomenon

MANY of nature's great manifestations pass us almost unheeded owing to the frequency of their occurrence and our consequent familiarity with them. Much as we should like to do so, we cannot pause in the business of life for more than a few moments at a time to speculate as to the origins and reasons of natural phenomena. An example which is always an exception is lightning. The relative infrequency and suddenness of its occurrence, its awe-inspiring character and the dangers associated with it invariably compel our immediate attention. Philosophers, scientists and engineers have speculated as to its nature. Electrical engineers particularly are interested in the magnitude of the electrical quantities associated with lightning phenomena. Estimates of these values, based on known electrical laws and on experiment in miniature, indicate such enormous values of voltage, current and energy as to make it difficult to believe that the true nature of the phenomenon is understood. This doubt is further enhanced by the erratic behavior of lightning.

An interesting contribution to speculation as to the nature of lightning is that of N. E. Dorsey, appearing in a recent number of the *Journal of the Franklin Institute*. He states that the only known form of electric discharge which could account for the known vagaries of lightning is the cathode stream, and he consequently traces the picture of a lightning stroke to the passage of electrons through the air. The electron moves in an electric field and its velocity is limited by its impact with molecules. As the strength of field increases the electron moves faster between collisions and begins to ionize the molecules, thus creating new electrons. With further increase, more molecules are ionized, more electrons formed, until finally it ionizes every molecule it encounters and about 15,000 new electrons are created in every centimeter of path. An increase of voltage and velocity beyond this point means that the balance between collisions and velocity no longer exists, and the number of ions produced per centimeter decreases as the velocity is increased. Thus the velocity is not only maintained but is still further increased. Balance is upset and the velocity tends to increase explosively; an elongated swarm of electrons is produced, reaching the order of millions of billions within a distance of a fraction of a millimeter. The condition is still further intensified by the mutual repulsion between the new electrons. This causes the swarm to spread, particularly in the direction of its motion, which makes the whole draw out into the form of a dart. The leading electrons moving under the original field are also subject to repulsion by the trailing electrons. Their acceleration is increased and they gain

energy. Thus in intense fields darts of electrons advancing with a velocity of light will result. Coming into electric fields of lower value and owing to collisions, even these high velocities are finally reduced so that the electrons lose their ionizing power and combine with the molecules, causing an abrupt change in velocity. The trailing electrons come piling up and are likewise stopped. The dart as the whole stops, and a mass of negative charge builds up rapidly, causing a local field which presently attains the critical value necessary for another start of the process of ionization. A new dart will start, generally in a new direction inclined to that of its parent. The mutual repulsion of this aggregation of electrons causes a region of gaseous rarefaction surrounded by a region of high pressure. The whole mass of positive ions produced by the new dart rush to the rear and, combining with the negative electrons, cause the rarefaction to collapse with an explosion. It is suggested that the characteristic rolling sound of thunder may be due to the rapid succession of such explosions.

It will thus be seen that it is not necessary to assume a difference of potential between cloud and ground which corresponds to the sparking distance. All that is necessary is a cumulative ionizing field at some point. The field of the remainder of the path need only have a value necessary to sustain the phenomenon described above. It appears probable that the amount of charge leaving the cloud is very limited. The light of the flash is occasioned by the recombination of the sluggish positive ions with trailing electrons. When the high-speed dart strikes a resisting object the electrons penetrate a certain distance before their velocity is reduced and they become attached to the molecules. When this occurs a large amount of kinetic energy is communicated to the molecule, and both electrical and mechanical stresses build up rapidly, resulting in the formation of violent disruptive effects. The speculations, based as they are on our increased knowledge of the electron and the passage of electricity through gases, make a much stronger appeal than the rough estimates based on sparking distances over gaps of limited length. We have here then another striking instance of the great value of scientific investigation and research in laying bare the inner workings of nature's great forces—in this case forces in which the electrical engineer is vitally interested.

More than Sound Public Relations Policies Needed

NECESSITY for sound policies on public relations is fundamental, but more is needed than sound policies. Two other things are essential. First, central-station executives must see that they have an organization which can properly interpret these policies; second, they should make it possible for department heads, particularly the man directly in charge of public relations work, to deal directly with the chief executive on matters of major importance.

If a capable and well-paid director of public relations must pass his ideas up to the top through several intermediate officers, there is too much danger of the real facts never reaching the executive who makes the final decision. If the department of public relations does not function properly, one of two things is wrong: Either it has not had an opportunity to prove itself or the man at its head is not capable. The remedy for the latter condition is obvious—get another man. But if the man is capable and yet is practically powerless to carry out policies he knows from the facts in his possession are sound and is unable to get these facts before the highest executive, then the executive is at fault.

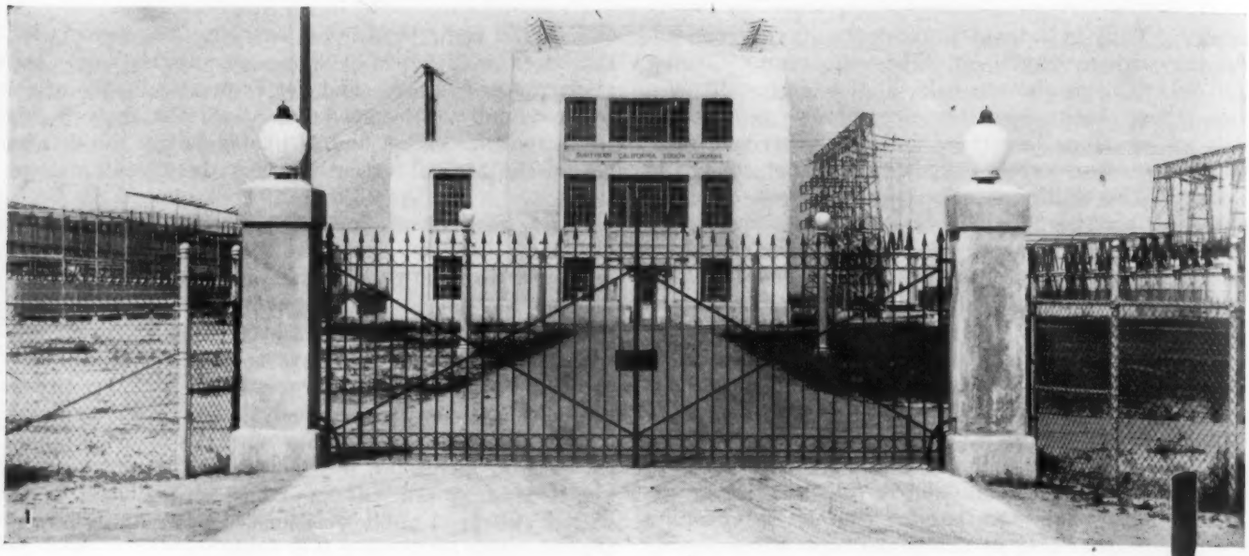
Busy executives are inclined to accept the department of public relations as a necessity along with all the other machinery of central-station organization and then proceed to make decisions in important matters affecting public policy and public relations without seeking the counsel of the man they have employed to make such matters his business. Of course, the high executives are responsible in the final analysis and must often pursue policies not in conformity with the ideas of others in their organizations, but they should weigh carefully and understand the reasons of men intimately in touch with problems of public relations before making important decisions concerning this work.

Appraising and Pushing Lighting Development

ALTHOUGH artificial lighting is going forward by leaps and bounds, appraisal of its progress depends upon viewpoint. In retrospect this progress seems sufficient, even wonderful. But the student of artificial lighting realizes that only a good beginning has been made. To him its possibilities lie not only in the future but also in the present. Of course, artificial light has become so complexly interwoven with activities of all kinds that it will develop steadily with the help of only a few who by nature are progressives. Those in the lighting business may, therefore, look forward confidently to steady expansion; but this does not mean that they will enjoy all that present opportunities hold forth, unless all bend their shoulders to the work of development.

What rate of development is possible, economical and desirable? Artificial lighting, like other lines of business, is confronted with inertia. The potentiality of artificial light has increased so enormously in recent years that an adequate "lighting consciousness" is far from generally developed. If one contemplates moving a cannon ball, one may kick it or one may push it continuously. The latter is the better method, and to keep the ball rolling and have it gain in motion one must keep after it continuously and, of course, recruit other pushers.

The advantages of adequate and proper artificial lighting have been well demonstrated in many fields, and the commercial possibilities of the present have been shown to be enormous. The pushers are profiting by their work, but too many lighting interests are still content with natural progress plus the acceleration from the relatively few pushers. Their own profit and that of the public should add them to the number if conscience does not. Perhaps their attitude of unconcern is due to ignorance of both the desirability and the possibility of better lighting. If so, authoritative data are available which will show the profitableness of better lighting. The pushers are keeping the ball rolling, but it can be moved much faster with the aid of all who profit from its motion. Much of the profit goes to the pushers, as well as a satisfaction that non-pushers cannot share.

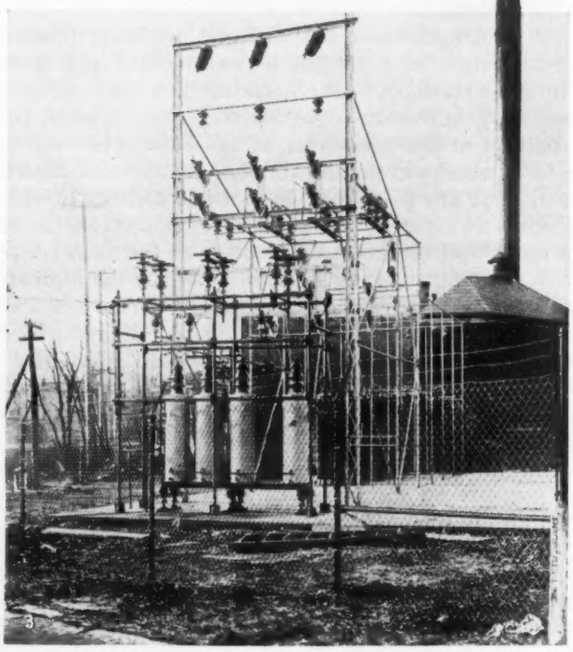


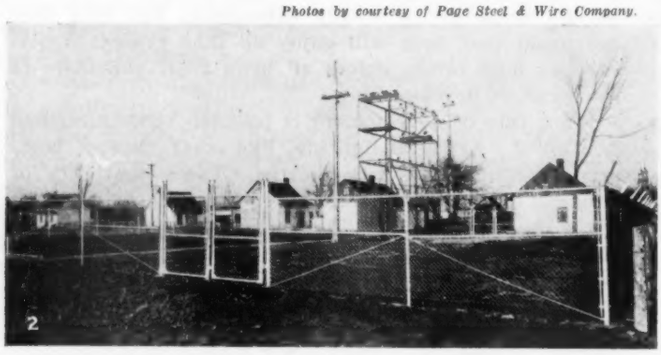
Fences Can Be Ornamental as Well as Useful

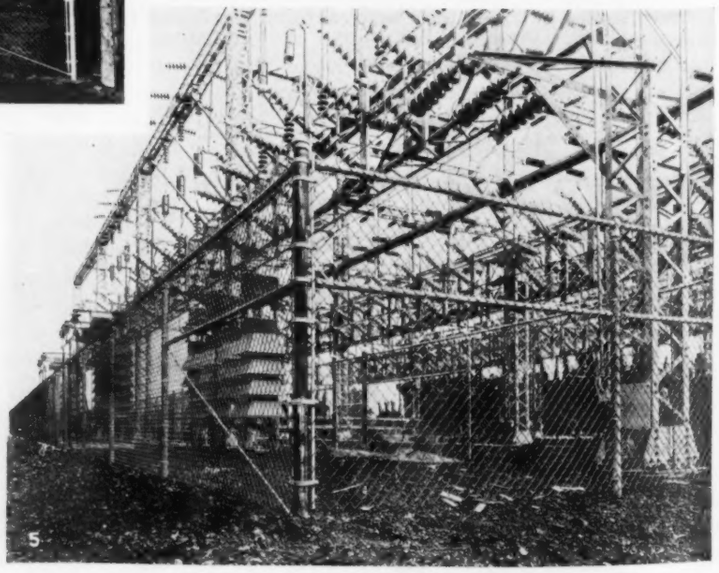
IT IS true that none of the fences here pictured provides a breath-taking glimpse of beauty, but they do possess a greater esthetic appeal than many that obstruct the landscape. And it is possible with this type of heavily galvanized fencing to permit and encourage vines and creepers to sprawl their verdant masses along the stark length of the barrier.

1. Laguna Bell substation, Southern California Edison Company.
2. St. Eustache, Quebec, Shawinigan Water & Power Company.
3. Sidney, Ohio; Miami Valley Electric Company.
4. Dallas Power & Light Company.
5. Lenore station, Central Indiana Power Company.

Photos by courtesy of Page Steel & Wire Company.







Water Supply Maintenance Difficulties

Snow and Anchor Ice Obstruct High Altitude Ditch to Hydro-Electric Plant—Air Heating Keeps Siphons Clear—Deer Enjoy Cold Baths—Spring Run-Off Washes Out Sides

By JAMES R. JOHNSON
Superintendent Hydro-Electric Production,
Western States Gas & Electric Company, Stockton, Cal.

ICE AND SNOW ARE ONE OF THE CHIEF SOURCES OF TROUBLE IN MAINTAINING THE OPEN CANAL SUPPLYING WATER TO THE EL DORADO PLANT OF THE WESTERN STATES GAS & ELECTRIC COMPANY

SERVICE on a 23-mile open ditch and flume is difficult to maintain even under the most favorable conditions, but when such a water supply to a hydro-electric plant is located at an elevation of nearly 4,000 ft. in a country subject to heavy snowfall and low temperature the task is doubly difficult. The experience of the Western States Gas & Electric Company with its combination concrete-lined ditch, earth ditch, flume and two inverted siphons supplying water to its El Dorado hydro-electric plant in the high sierras of central California is highly interesting and shows to what length a power company goes to maintain its high standard of service.

Water is diverted from the south fork of the American River at elevation 3,912 ft. and is conveyed through a canal with an average gradient of 4.5 ft. per mile for a distance of 23 miles to the forebay above the plant at an elevation of 3,795 ft. The canal is designed for a maximum flow of 150 sec.-ft.

Great difficulty was experienced because of deer getting into the ditch, particularly the concrete-lined sections, during the first few months of operation. Deer crossings were put in at all deer trails and made as inviting as possible by placing earth on the runways and nailing fir boughs along the sides. Such a crossing is shown in one of the accompanying views. Ladders were also installed along the smooth concrete walls to give those unfortunate enough to fall in a chance to climb out without injury. These expedients failed in a large measure to accomplish the desired results. A careful check and marking system developed the fact that the same deer were repeatedly pulled out of the canal and a great many deer were more or less injured by their experiences. It was then decided to fence in the entire concrete-lined section, about five miles, and so compel the deer to take the bridges. This was done and has solved the problem except for an occasional inquisitive animal which gets in by either jumping the fence or pushing under.

After the deer have migrated to the sunny southern slopes and the thermometer has dropped to between 20 deg. and 40 deg. the winter fight to keep the canal free from ice and snow begins. Anchor ice is the most pernicious form, although a heavy snowfall presents its difficulties also. Anchor ice forms along battens, on nail heads, on black sand and in eddies, and rapidly develops in size and weight to retard flow and raise the water level. Electric float alarms that can be set for both high and low water ring into the patrolmen's houses whenever there is any material change in ditch water level, indicating the section in question and starting an alarm bell that rings steadily until cut off. There are seven alarm stations along the canal, each having from three to six drops each, each drop connecting with a float switch at some section. The alarm system has proved very reliable in indicating trouble

DITCH BREAK CAUSED BY A HEAVY BURDEN OF SNOW

from ice, slides or ditch breaks. Automatic spillways (see illustration) of various designs to suit different localities work in conjunction with the alarm system to take care of extraordinary conditions.

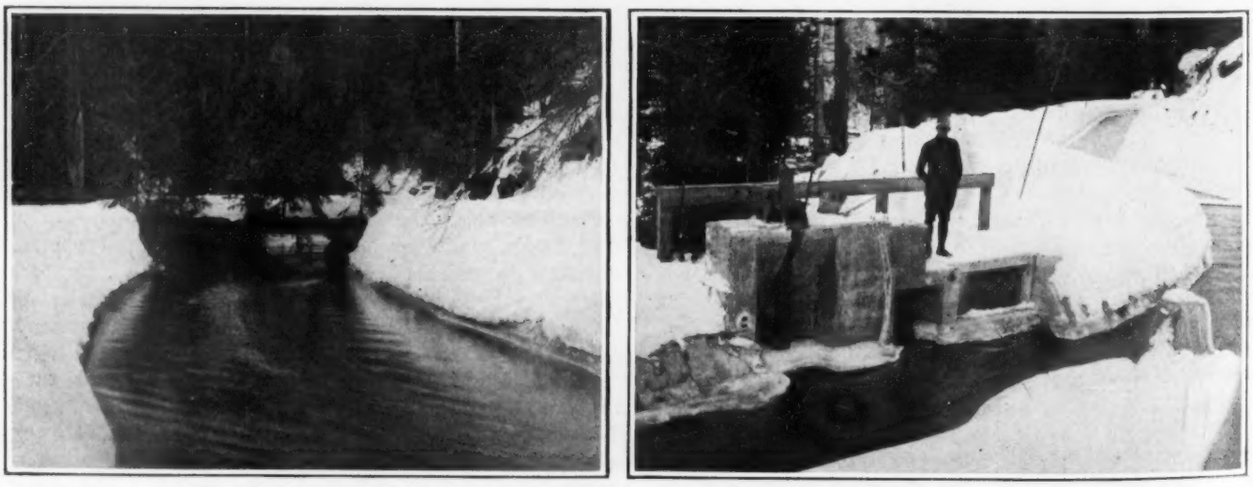
After some experience with anchor ice it has been found impracticable to try to do much toward freeing it, unless urgently necessary to save a ditch or flume, before late morning, when the sun can usually be depended upon to effect its release. With this end in mind the brush has been cleared away from bad sections to permit the sun to shine full on the flume and ditch as early as possible. It was also found that overhanging boughs were a menace in that they tend to drop their burden of snow into the water and form a nucleus for a heavy accumulation of ice and snow.

At three points on the canal provision is made for removing the accumulation of floating ice and snow by means of shear boards and crest type spillways. There is such a station at the intake portal of each siphon and one just ahead of the forebay. At these points a shed spans the canal and spillway structure with a small cabin alongside. This gives shelter and provides relief for the crew raking ice, work that must go on continuously as long as the ice runs.

The outlet portals of the siphons gave considerable trouble during the first winter of operation by freezing back and into the siphon outlet, thus tending to retard the flow. It was found by experiment that ice would not form there if the air was kept above 32 deg. Heater houses are now installed at these points and light fires are maintained on cold nights. No trouble is experienced with ice formation on screens, gates or metal parts of any sort projecting into the water if the air surrounding these parts is kept above 32 deg. It is, of course, useless to attempt to warm the water, although a small fraction of a degree would probably be sufficient; it is necessary merely to maintain the air temperature just above the freezing point of the water—a much easier job.

When the warm spring rains begin and until they end another menace to continuous operation develops. The rainfall at this elevation is heavy and, combined with its effect on snowdrifts, results in a heavy runoff. Ditch banks are softened, slides develop and ditches are frequently overburdened by sudden freshets, hence constant vigilance has to be exercised to anticipate and avoid trouble from this source. Ditch leaks form still another source of trouble that develops at unexpected places and taxes the patience and ingenuity of the ditch foremen. Various means are used to stop them. Clay core-walls put down in ditch banks to cut off bank leaks can be put in without unwatering the canal. Clay plugs, often man size, are used to stop bottom leaks, and porous sections are silted to stop heavy seepage. As a precaution against a protracted shut-down caused by a ditch break, flume lumber, framed for the most part, is stored at strategic points to facilitate the rapid construction of flume sections over and across these breaks.

Continuous service is almost as essential as regards water supply as it is in regard to demand for energy at the station bus. An organized, experienced crew must be maintained to cope with any and every emergency.



AT LEFT, AN EARLY TYPE OF DEER CROSSING. THIS DID NOT PROVE EFFECTIVE AND SECTIONS OF THE CANAL HAD TO BE FENCED LATER. AT RIGHT, CONCRETE SPILLWAY STRUCTURE, SHOWING FORMATION OF ICE

Codes and Standards*

Social Significance Established on Basis of Tradition—Too Many Standards Have No Basis of Established Practice—Compromise Standards Worthless —Utility Service and Standards

By JOHN C. PARKER
Vice-President Brooklyn Edison Company

WHAT do codes and standards signify? Isn't the question relative? Can it be answered before one has indicated the person to whom they do their signifying? This country recently adopted a code which in effect is a long way yet from having become a standard of practice, and there are about 110,000,000 different significances attaching to that particular code. To some it was the dawn of a moral millennium, to others the initiation of personal, mental, moral and political slavery, to certain large commercial interests a death warrant, to others less established commercial interests a source of adventurous wealth, and to the weather a rank usurpation of its former place as the universal topic of conversation as well as of the fact that while it's much talked about, nobody ever does anything about it.

Codes always signify different things to different men, one man's meat continuing to be another man's poison. Not being a professional reformer, and being fully aware that most people—like himself—are entirely and humanly fallible, and again in the light of the well-established lessons of history, the speaker has very definite convictions as to the place and proper scope of codes and standards, whether moral, political, technical or commercial.

It is not mere accident that has given the English-speaking races the background of a flexible constitution and of a body of common law, nor is it merely a coincidence that these political and legal institutions find their origin in a nation that, with her offspring, has given the world economic theory, commercial and personal initiative and democracy. While the founders of this Republic adopted a written constitution, they were faithful to their heritage in crystallizing into that constitution the fundamentals of freedom under the law, and their sons have felt equally free by interpretation to make that constitution an ever-flexible instrument in the expression of current needs and thought.

Freedom of Interpretation

Nor can it be said that instability of governmental and political organization has resulted from that freedom of interpretation. Rather, I think it will be recognized that a sound constitutional interpretation and a mass of decisions constituting the body of the common law give the least occasion for revolutionary change, that an interpretation of the political philosophy of a people adjusting and adapting itself as that people grows in wisdom and experience constitutes a massive anchorage point, the more enduring because of its flexibility. In contrast to such a condition may one note the revolutionary changes, the violent eruption of outraged opinion, which invariably has followed a stiff and inflexible organization of state or church.

When this Republic and its component states have chosen to make enactments at variance with our fundamental Anglo-Saxon traditions, the enactments have fallen into disrepute and unhappy results have followed. Please note that I do not refer to the latest but one of our constitutional amendments, nor to the congressional acts sequent thereon. Rather, I would indicate the constitutional provisions following our war between the states in contrast to the latest of our constitutional amendments. The latter was so full an expression of what each of us in his own home has come to recognize as a most desirable balance of power—if the mere male ever could attain to equality—that the woman suffrage amendment brought itself into being without the slightest jar and has never in the slightest degree been controverted, nor is any attempt at all likely to be made in the direction of nullification. You see, the point is that we had economically and socially long since recognized the rights and fitness of women, so that a formal codification just naturally couldn't help commending itself to everybody. This it seems to me is the essence of any code, of any standard, that it must be an expression, not of the will of a narrow majority, but of the preponderating thought and feeling of substantially an entire group.

Compelling Motives of Conduct

Now, if you please, and apparently a little afield from the subject under discussion, may I inquire what each of us finds to be the compelling motive in his personal conduct. I think it not too much to say that neither the law of the land nor the tenets of organized religion so profoundly influence a man's personal conduct as does the social tradition to which he is accustomed. Call this tradition what one will—standard of sportsmanship, courtesy, manners or what not—it is a fact that very few of us have the moral courage to order our goings very differently from those of the group with whom we commonly associate. This, I rather believe, is about as it should be if we are going to live in an organized society based on co-operation and interdependence.

I seem to have noted that each of us in his salad days revolts against the stupidity of many of these social traditions and inhibitions and that in time he discovers that none of them have come into being without some fairly good reason for existence. I suspect that each of us has discovered his own revolts to be less frequent and less violent as the years bring patience and let us hope wisdom. So, if you please, I have, in matters of business and of scientific practice, more faith in tradition than in legislation, both in the matter of efficacy and in that of fundamental soundness.

*Abstract of address made at N. E. L. A. convention, Atlantic City, May 20.

Not for a moment do I believe that all codes and standards are bad. This rather definitely would gainsay historical truth and social experience. Rather, I would suggest that no code, no standard, ever should be set up until a mass of tradition has proved it, and then only in the event of one of two necessities—the first being clarification, the second the compulsion of a willful minority.

At its best, any code is bound to be comprehensive but individual expression at its worst, a series of compromises. Individual perspicacity is limited. The human mind can grasp, retain and express only a fraction of its own very limited experience. It cannot give expression to all of this experience and assuredly cannot give expression to experience that it has not had. Therefore, the wisest individual or the most harmonious group attempting a codification simply cannot comprehend all conditions that may arise contemporaneously and easily enough may lay a dead statutory hand on the unborn generations.

UNNECESSARY CODES TO BE AVOIDED

If, as is more likely the case, a code is set up by a group of individuals of divers and individually limited experience, each seeking self rather than the social good and the group concerned with making the minimum of concession to one another, perhaps ruthlessly indifferent to interests not represented at all yet profoundly affected by the code, it is obvious that social harm will result contemporaneously and that the future will heavily pay the piper. I need not suggest to you, gentlemen, that a compromise of necessity always expresses an ideal somewhat below that of the average individual in the group. Corporately men often do what individually they would abhor.

So, if you please, I would avoid all codes, statutes and standards except when they are positively necessary and actually realize a practice already substantially approved by use. I can see value in a code, in a standard, which for conventional purposes defines so that there shall be no doubt in the minds of honestly intentioned men each as to what the other is talking about, each as to what the other is trying to accomplish. I recognize the absolute necessity of codes and standards in sufficiently important matters when a recalcitrant minority stubbornly refuses to accord with the almost universal desire. . . .

Now, this industry of ours does not live a life apart from our times, and although not a professional alarmist, I confess myself seriously disturbed at the tendency growing among us to premature standardization and codification by this, that and the other body. Seriously, I doubt whether the electrical industry is old enough to have established its traditions. Certainly, there is enough divergence in practice here, there and in the other place to indicate that there is precious little unanimity of opinion about most things, nor when we attempt to codify do I find that the social conscience within the industry has evolved to the point where we think in turns fundamentally social.

The speaker frankly recognizes himself to be no more immune to the prejudice of self-interest than others and so feels rather free to make the charge that most members of this association take a definite view with reference to every blessed code and standard that comes up pretty much in the light of company experience, that then when individual preferences and prejudices have sufficiently been compromised to find the lowest common multiple of our association position, the N.E.L.A. enters into negotiations with other commercial bodies and with the professional bodies having in mind our agreed provincial position, and then by a process of whittling and hammering and tinkering in general the divergent groups gradually get together on something that satisfies none in its entirety and probably in the main is pretty ruthless of the interests of John Henry, the ultimate consumer.

We writhe and squirm and are outraged when some external group—let us say, merely for purposes of illustration, a supposititious manufacturer's organization—adopts a standard which affects, again let us assume, what guarantees shall attach to circuit breakers. We are perfectly willing to sit in the seats of the mighty and decree for those who pay very much more heavily than we do for our circuit breakers that our customers shall do thus and so with reference to the starting currents that they take from our lines. Of course, we are the people and verily wisdom shall die with us, but I suspect that our customers, were they vocal, would voice about as much discomfort under some of our codes and standards as would we, the customers of this entirely hypothetical manufacturing organization, were it to venture its rules affecting our purchases without first consulting us. Gentlemen, in all sincerity, I feel that we as trustees for the public from whom we have derived our franchises have laid on us a positive duty to prevent the formulation of any codes, of any standards that shall arrest the progress of the industry or place the deadening hand of statute on initiative and ingenuity.

LEGALISM AND THE CUSTOMER

There is an aspect of this whole legalistic trend which is to my way of thinking considerably more serious than the immediate and objective and which has in the main to do with the process of codification by our individual companies. Ages ago, out of their fragmentary experience, our corporate forebears set up certain standards, possibly necessary, possibly even very good in their way, but so closely drawn that they fail utterly to meet modern conditions, and these blue laws, having once been enacted, remain unto this day. Rather, they have grown by accretion until a customer wishing to do business with one of our companies—a lay customer, mind you, who oughtn't to have to know anything about our miserable technique and about boards of fire underwriters and societies of Eastern or Western inspectors and departments of water, supply, gas and electricity and state railway commissions and national safety codes and Bureau of Standards enactments and Power Club rules—just naturally can't come up to the counter and ask for 50 kilowatt-hours to be wrapped up in a neat bundle and delivered to his house charged to his monthly account, but rather has to go through making an application in which he subscribes to a fine-print waiver of all his property, his rights as an American citizen and his hopes of everlasting salvation. He then runs the gamut of the credit department and the claim bureau and negotiates with his contractor and then gets a violation slapped on by the company or any one of a half a dozen official bodies, and in the course of time just before he is gathered to his fathers he has opportunity to make a limited and restricted use of the commodity in which we claim to be rendering public service.

Interchange of Energy*

Description of Chicago District Interchange Energy Contract— A Discussion of the Basis of Interchange Rates Where Water Power Is Involved

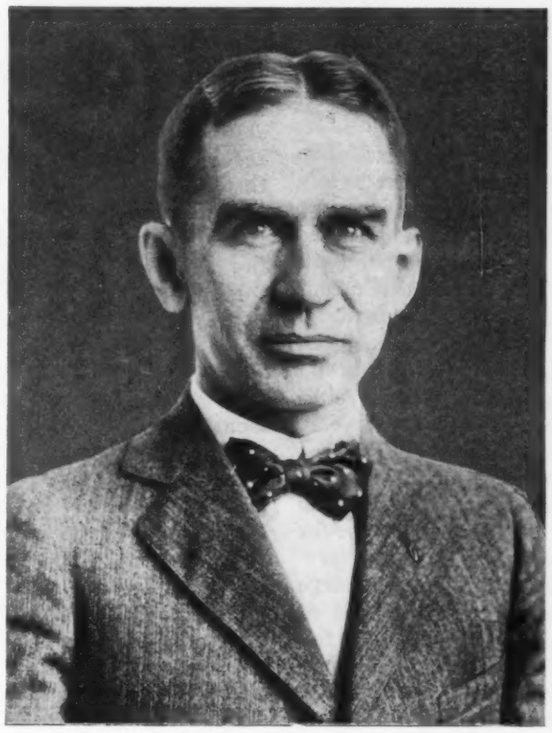
By EDWIN J. FOWLER
Statistician Commonwealth Edison Company, Chicago

THE necessity for interchange of energy contracts has been brought about by the development, principally during the last decade, of the transmission of energy from centrally located, high-efficiency generating stations, and the development and spreading out of transmission system networks over wide areas to the point where they come in approximate contact and are interconnected with neighboring systems.

The economic advantages of interconnection are:

1. Protection of continuity of service largely due to diversity of generating supply.

For instance, generating capacity may be in the form of modern, large-capacity steam stations located in the great load centers, in those cases where ample condensing water supply is available; it may be in the form of water power, either run-of-the-river with little or no storage, or a high-head storage or peak-capacity water power, or it may be one of the modern types of steam stations located at the mine mouth in those favored locations where both coal and ample water are available.



E. J. FOWLER

2. Conservation of capacity and capital due to load diversity and improved load factor.

This factor has been recognized for many years and is important, but its importance has perhaps been overestimated—at any rate the diversity of load alone will seldom justify the many interconnections that have taken place.

3. Conservation of capacity and capital because pooling reserves reduce the amount necessary for equal protection.

For instance, to accomplish the many savings that come from the installation of large-sized units, many systems, for a year or two, carry a much larger percentage of reserve than is necessary, and where systems are properly interconnected with their neighbors and proper co-operation exists as to planning for additional capacity, this temporary excess of reserve can usually be used to advantage.

4. Relaying of power because of drought, high water, breakdowns and other abnormal conditions.

The best example of this is the manner in which the situation that existed in the Southeastern States during the past summer was handled.

5. To effect operating economies and conservation of coal through better distribution of load on the more economical stations.

It is the opinion of the writer that this matter of economies in operation is more important than is generally recognized and that these economies in many cases are not being realized because of the difficulty of working out an equitable basis for sharing the savings to be made.

In those cases where a transmission network is owned and operated by one company most of the economic advantages of this modern development probably are realized, but where two or more adjacent transmission networks are interconnected and are owned and operated by different companies or different interests, all of the advantages of interconnection are seldom realized, and even in those cases where the interconnected systems, though operated by separate companies, are controlled by the same interests or holding companies, all of the economies are not usually effected.

At first thought it may seem that the establishment of equitable forms of interconnection rates becomes a matter of decreasing importance as the large holding or group companies absorb more and more neighboring companies and further consolidate. This is probably true to some extent, but the fact should be kept in mind that there are a great many different groups throughout the country—more than 100; that this number is multiplied many times, so far as geographic contact with other groups is concerned, by the diversification policy of most of these groups, of controlling subsidiaries in widely separated sections of the country, and so there remains, and there probably always will be, a great many points where there should be interconnection and interchange among different companies or different interests.

Interconnection contracts, fully to attain desired economies, should be based on interchange or pooling and the use by all of the available reserve capacity, and not on a charge for maximum load delivered, but on a charge per kilowatt of capacity that one or more companies may supply to the pool against the company or companies that are short and draw upon the pool.

*Abstract of an address before the National Electric Light Association at Atlantic City, May 20, 1926.

Also, the secondary charge for energy should not be a fixed rate but should be based on the operating cost of the station from which supplied.

Better to illustrate, I shall now describe the more important features of the Chicago district interchange energy contact, which is based on the general principles outlined above.

The working committee, consisting of two representatives from each of the three companies interested, has drawn up and agreed upon a list of the rated capacity of the three companies. It also obtains a statement of the system maximum load, each month that there is an increase, for each of the three companies, and from the total capacity and the total load for the group are then obtained the total reserve capacity and per cent reserve of the combined companies.

PRIMARY CHARGE

The individual company that has anything less than this average per cent reserve will pay into the pool a primary charge on a sufficient number of kilowatts to bring the reserve for that particular company up to the average of the pool, but not to exceed 20 per cent, and correspondingly, the company that has a per cent reserve in excess of the average for the pool will receive from the pool payment of a primary charge on the number of kilowatts obtained by multiplying its load by the average per cent reserve of the pool and subtracting this required reserve from its actual reserve.

The amount paid in and the amount paid out, of course, will balance. In other words, the company or companies that are short of capacity under this plan will pay a primary charge to the other member or members of the pool that have a surplus of capacity.

And here is an important point: The primary charge under this arrangement is based upon the relation of maximum load for the year to capacity; hence it follows that one company may take from the other company, so far as primary is concerned, any amount of maximum load for which there is capacity available, without in any way affecting the charge for capacity.

The following example will perhaps help toward a clearer understanding of the determination of the reserves and deficiencies on which the primary charges are based:

	Comp'y A Kw.	Comp'y B Kw.	Comp'y C Kw.	Total Kw.
Capacity	883,000	175,000	32,000	1,090,000
Maximum load	780,000	120,000	40,000	940,000
Reserve	103,000	55,000	8,000*	150,000
Per cent reserve	13.2	45.8	20.0*	16.00
16 per cent of above maximum	125,000	19,000	6,000	.....
Deficiency in reserve	22,000	.....	14,000	.....
Extra reserve capacity	.....	36,000	.....	.....

* Deficiency.

The primary rates for this capacity are as follows:

DEMAND CHARGES

First	5,000 kw. at $1.50 per kilowatt per month
Next	10,000 kw. at $1.35 per kilowatt per month
Next	15,000 kw. at $1.25 per kilowatt per month
Excess over	30,000 kw. at $1.20 per kilowatt per month

This primary charge is supposed to cover fixed charges on power house, step-up transformers where used and transmission line investment, and if it is desirable to include a definite profit in the rate, it should be included in the primary charge.

The kilowatt-hours delivered by one company to another are billed at the fuel cost of the station from which the energy is supplied, plus an amount per kilowatt-hour referred to in the following as R, to cover labor, supplies and repairs for each generating station as agreed upon and stated in the contract, and varying from one to two mills. This figure, in each case, should be large enough to compensate for transmission losses and any other small expense items.

Expressed as a formula, the secondary charge is determined as follows:

$$\frac{\text{Cost per ton} \times \text{lb. per kw.-hr.}}{2} + R = \text{mills per kw.-hr.}$$

No profit is included as such in this secondary charge, but when an additional output is added to a going station, it is usually added at an increment cost, and therefore the supplying company realizes as a profit the difference between its average operating cost and its increment cost.

Under this arrangement the company that is operating a rather inefficient plant of its own will shut down this plant or reduce its output if its neighboring company has more efficient capacity available.

SURPLUS ENERGY CHARGE

After the contract had been in operation for a few months it was realized that the secondary charge arrangement would not entirely meet the situation. The Commonwealth Edison Company had a fairly modern power house in the northern section of the city and the Public Service Company of Northern Illinois had a somewhat more modern power house in the northern suburbs.

The fuel cost for the Edison station was quite a little higher than that of the Public Service Company station, but the difference in the two was not equal to the R charge. Therefore, if the Edison company purchased energy from the more economical Public Service station at the latter's fuel cost plus the R charge, the rate figured out higher than the fuel cost of the Edison station. The labor, repairs and other expenses, which the R charge represents, of the Edison station went on regardless of whether energy was purchased or not, and likewise a similar cost went on at the Public Service Company station, whether it sold or not. The Public Service Company was anxious to supply the load in question from its station, as it gave it a better and more economical load for its two units, so the following arrangement was worked out, which has proved to the advantage of both parties:

If any company finds that additional output for any of its generating stations would result in considerable operating economies and that such surplus energy is not salable at the secondary charges specified in the contract, it may supply such additional output to any other company, provided the other company also finds it profitable and is willing to accept such additional output at fuel cost plus a charge of 0.2 mill per kilowatt-hour, which together may be designated as a surplus energy charge. This 0.2 mill, it should be understood, is materially less and takes the place of the R charge in the contract.

The contract provides that the parties shall confer and co-operate with one another before proceeding with the installation of any additional generating capacity

(whether at existing or at new sites) with a view to providing such capacity in such amounts and at such points in the interconnected system as will be of the greatest value to all the parties. This provision is considered very important as it provides the means of keeping the capacity within reasonable limits and should result in the installation of capacity at the most desirable locations.

This contract has been in operation now for more than a year among three companies that are operated and financed separately, but all three are Insull companies. Whether or not this form of contract can be successfully operated by companies under entirely distinct and separate management remains to be seen. Its success, however, in the Chicago district situation has been complete. It has been possible for the operating men to put the load on the most economical stations regardless of ownership and it has distributed the primary charge in a manner which has proved to be equitable and satisfactory.

The writer has not dealt extensively with interchange rate or contract problems of companies largely dependent on water power, but after a study of the interchange conditions and the contracts among the companies in Tennessee, Alabama and Georgia, made on a recent trip to Atlanta, the following ideas occur to him as at least worthy of consideration as a basis for further study and thought:

Proposed Basis of Interchange Rates Where Water Power Is Involved

The application of the general principles of the Chicago district contract, as to pooling of load and capacity, will include steam capacity at 100 per cent of generator rating, the run-of-the-river water power at 40 per cent to 75 per cent of rating, dependent upon the general characteristics and history of the river and watershed, and to be agreed upon in advance by the different members of the pool, and will include water powers protected by storage reservoirs at from 80 per cent to 100 per cent of rated generated capacity, dependent upon the amount of storage and the average year's experience with same, by agreement.

1. *Primary Charge.*—A primary charge similar to that in the Chicago district contract and based upon the average steam station investment cost per kilowatt; this primary charge to be applied to the deficiency in reserve capacity for those members of the agreement that are deficient, the amount of the deficiency to be determined from the relation of load and capacity as heretofore described for the Chicago district contract.

2. *Secondary Charge—"A."* The kilowatt-hours supplied by one company to another should be charged for at slightly above the operating cost of the station, either steam or water, from which it is supplied, due correction first having been applied to the kilowatt-hours to allow for line losses, excepting in the case of relayed energy, where the operating cost of the station from which the energy was first drawn should be used.

3. *Secondary Charge—"B."* To compensate for the underrating of water power capacity, as proposed in a preceding paragraph, and to compensate for those cases where the water-power development, excluding storage reservoir investment, is in excess of the more or less standard steam station investment cost of $120 per kilowatt, it is proposed that an additional secondary charge, which we shall call secondary charge "B," should be made against the kilowatt-hour output supplied to a neighboring company from such water-power stations as are rated at less than 100 per cent and/or cost in excess of $120 per kilowatt. It is suggested that the amount of this charge should be determined by dividing the water-power station investment that is not covered in the primary charge by the annual kilowatt-hour output capacity of the station, as determined by the average of several preceding years' experience, or in the case of a new station by the estimated annual output; this figure to include a moderate allowance for contingencies and to be determined and agreed upon between the parties to the contract. The purpose of this charge is to compensate the company the capacity of which is partly or all in the form of water power for its higher investment cost, if it is higher, and for the underrating of the capacity, if it is agreed to underrate it. Without this charge, neighboring companies might get the advantage of purchasing kilowatt-hour output at very low operating cost without paying their whole share of fixed charges, and at the same time it does not work out well to try to put the higher investment cost in the primary charge.

4. *Seconday Charge—"C."* In case the supply of energy by one company to another requires drawing upon storage water an additional charge per kilowatt-hour is proposed, which we shall call secondary charge "C," to cover fixed charges on storage investment and operating of same, as determined by dividing this annual expense by the annual kilowatt-hour output drawn from storage, as averaged from the records of storage reservoir performance for a period of years.

If it seems desirable, both secondary charges "B" and "C" might be refigured after the close of the year, and the billing be based upon the actual results of that particular year instead of upon approximate averages of a number of years.

Special conditions might arise where it would be to the advantage of two or more parties to the contract to omit the secondary charge "B"; for instance, if one company has storage reservoirs that are not filled and it is not sure that it is going to be able to fill them before such time as it might wish to draw upon them, and a neighboring company has run-of-the-river water power going to waste, the first company would usually be warranted in paying the nominal secondary charge "A" in order to insure filling its reservoir and avoiding the possible later use of steam-generated output. On the other hand, the first company, of course, not knowing for sure but that it might have more rainfall than it expected, enabling it to fill its reservoir without purchasing from its neighbor, might not feel justified in paying both secondary charges "A" and "B." Thus if one company finds that its surplus energy is not salable, it may supply such additional output to any other company, provided the other company also finds it profitable and is willing to accept such additional output at secondary charge "A" only.

Primary payments for capacity thus not being dependent upon the actual maximum kilowatts interchanged, it is believed that the kilowatt-hours will be freely interchanged without artificial barrier and dependent only on relative operating cost of the different stations and the kilowatt-hour capacity available. In other words, the various power houses in the pool would be operated pretty much as though they were all controlled by any one company.

Allocating Capacity Costs

Peak Responsibility a Safe But Inaccurate Index of Capacity Costs—Maximum Demand Both Unsafe and Inaccurate—Other Measures Considered—Two Safe and Accurate Yardsticks Submitted

By W. J. GREENE
Rate Engineer Iowa Railway & Light Corporation

THE article by A. S. Knight on "Peak Responsibility as a Basis for Allocating Fixed Costs," which appeared in the March 6 issue of the ELECTRICAL WORLD, and the article by H. A. Snow on "Sharing Benefits of Diversity in Loads," which appeared in the Feb. 20, 1926, issue of the same paper, give a clear presentation of most of the objections to the use of peak responsibility as a measure of capacity costs. The writer fully agrees with the statements of objections, but does not agree with the claims that maximum demand offers a fair, accurate and safe measure for the apportionment of capacity costs.

PEAK RESPONSIBILITY AND MODIFICATIONS

The peak responsibility method has one virtue, which is that if used exclusively for all consumers, the recovery of the total capacity cost is assured, provided no consumer fails to pay for service until a new group of peak responsibility consumers assume the costs. Where the demand method is used and the unit demand charge is established on one year's records and used for several succeeding years, there is grave danger of taking on more business with load factors above the weighted average of the base year (the business that would be taken at less than cost) than business with load factors below the weighted average (business that would be taken at above cost), thus causing a loss in net revenue. This will be made clearer by an example given later, when it will also be shown that maximum demand alone is not an accurate measure of capacity costs.

One very serious objection to the peak responsibility method, not mentioned by Mr. Knight or Mr. Snow, is the cost of applying the method for general use. This would bar the method for such use, even if it were accurate and possessed none of the other objections.

Yet, with all its objectionable features, the writer is not ready to abandon the use of peak responsibility with modifications for certain purposes. One use is for allocating boiler or steam plant investments and capacity costs to electric and steam systems (such as a district heating system) and for allocating investments and capacity costs of an electric plant to the electric systems served directly from the switchboard. The other use is for large consumers who cannot be served as a group but who can arrange a major portion of their loads to come at off-peak times.

The "peak responsibility and average hourly load" method of allocating plant costs does not permit any class of user to escape paying something for capacity costs, as does the straight peak responsibility method. Furthermore, by averaging a number of peak responsibilities the effect of shifting loads is reduced and the method is made to approach more closely to accuracy. It is believed that the reduction in unit energy costs to all other classes due to the increased off-peak consumption of electricity fully offsets the benefits given to the off-peak system. The method gives the utility an opportunity to add or encourage the additions of systems that might not otherwise be secured.

OTHER METHODS FOR MEASURING CAPACITY COST

Besides the "peak responsibility," "maximum demand" and "peak responsibility and average hourly load" methods, there is also the "consumption method." The consumption method is safe and accurate for those consumers of a class who have and can be depended upon to maintain substantially the same annual load factor as the other consumers of the class. In addition to the foregoing methods, the writer submits two other methods, one of which was presented in full in Nov. 7, 1925, issue of the ELECTRICAL WORLD and is called the "consumption and demand" method. It consists of the solution of the following equations: $Kx + Dy = C$ and $8{,}760x + y = C \div P$. An explanation of the symbols is given in the article mentioned.

Principles Governing Accurate and Equitable Distribution of Diversity Benefit

1. Potentially, a consumer's diversity factor is the reciprocal of his load factor.

2. Actually, a consumer's diversity factor is unity or somewhere between unity and the reciprocal of the load factor, depending upon the coincidence or non-coincidence of maximum demands.

3. The diversity of a group of consumers is the ratio of the sum of the consumers' maximum demands to their maximum coincident demand.

4. The benefit of uncontrolled diversity is a community of all interests.

5. The benefits of controlled diversity belong to those effecting the control.

6. For an accurate and equitable distribution of the benefits of the uncontrolled diversity, due weight must be given to consumption, maximum demand and maximum coincident demand, or the potential diversity of each system or consumers of a system, and the actual diversity of all systems or consumers of a system.

7. Either the "consumption and demand" method or the "used and unused capacity" method give an accurate and equitable distribution of the benefits of diversity, because consumption, maximum demand and maximum coincident demand are weighed with mathematical precision.

The other method is the "used and unused capacity" method.

The "used and unused capacity" method may be expressed algebraically by equations:

$$Kx^1 + (D - H)y^1 = C$$
$$8{,}760x^1 = C \div P$$

In which x^1 = the per kilowatt-hour capacity cost of used portion, y^1 = the per kilowatt-ampere of demand minus average hourly load capacity cost of unused portion, H = average hourly load, and the other symbols have the same meaning as in the equations for the "consumption and demand" method.

Application of Various Methods

The results of allocating $720 capacity costs to ten consumers of a class are shown in section *A* of the accompanying table. The peak load of the class, the maximum demands of the consumers, and the 24-hour kilowatt-hour consumption of each consumer are the same as the values used by Mr. Reed in his letter that appeared on pages 508 and 509 of the March 6, 1926, issue of the ELECTRICAL WORLD. A period of one year is covered in order that larger values may be had. Each consumer is assumed to have a 100 per cent power factor so that the loads could be given in kilowatts. The six methods by which the capacity costs of each consumer are worked out will hereinafter be referred to by the column numbers indicating the method.

Attention is drawn to the danger that lurks in the straight demand method when trying to convince customers of the necessity of capacity costs unless the utility can maintain constantly the same weighted load factor for all of its customers. Assume that all available low load-factor business is represented by the ten consumers shown in the table and that there was a prospective 100 per cent 10-kw. customer whom the utility had not been able to secure because of the high peak responsibility charge due to the extra costs of transmission, distribution and transformation required by the utility for rendering the service and not involved in the prospect's plant. With a demand charge of $24 per year per kilowatt, or a total of $240, such a consumer should be readily secured. The power-plant requirements, with the additional 10-kw. 100 per cent load-factor consumer, now becomes 20 kw., and the capacity cost is increased approximately $720, with a resulting loss of approximately $480 a year.

It is possible that all residence consumers with only lamps installed have substantially the same load factor, that all residence consumers with lamps and small devices have substantially the same load factor and that all residences with lamps, small devices and ranges have substantially the same load factor. If investigations prove the foregoing consistency in load factors and that the maximum departure of any residence consumer's annual load factor from a weighted average of all the residence consumers is not sufficient to cause an error in assigning capacity costs greater than would be the annual costs of a demand meter, the capacity charges could be safely and equitably recovered by a three-step meter rate.

Since in the equations $Kx + Dy = C$ and $Kx^1 + (D - H)y^1 = C$, capacity costs determined by either method must be the same. Furthermore, both methods measure the effect of consumption, maximum demand and the maximum coincident demand, and thereby the potential diversity of each and every system or consumer of a system. Therefore the capacity costs of each system or consumer found by either method is determined with arithmetical accuracy. The results given in columns 6 and 7 of the accompanying table therefore represent

Allocation of Capacity Cost by Various Methods

		Particulars				Capacity Costs					
Col. No....	1	2	3	4	5	6	7	8	9	10	11
	Customer Number	Peak Responsibility of Customers and Maximum Demand of System, Kw.	Maximum Demand in Kw.	Consumption per Year, Kw.-Hr.	Load Factor, Per Cent	Consumption and Demand Method	Used and Unused Capacity Method	Demand Method	Consumption Method	Peak Responsibility and Average Hourly Load Method	Peak Responsibility Method
A	1	1	1	8,760	100.0	$72.00	$72.00	$24.00	$96.00	$72.00	$72.00
	2	1	2	9,125	52.1	82.67	82.67	48.00	100.00	75.02	72.00
	3	2	3	18,250	69.4	157.33	157.33	72.00	200.00	149.98	144.00
	4	0	3	1,095	4.1	32.00	32.00	72.00	12.00	9.00	0.00
	5	1	6	2,190	4.1	64.00	64.00	144.00	24.00	56.59	72.00
	6	0	2	2,190	12.5	32.00	32.00	48.00	24.00	18.00	0.00
	7	2	4	2,190	6.2	48.00	48.00	96.00	24.00	108.00	144.00
	8	3	4	17,520	50.0	160.00	160.00	96.00	192.00	195.41	216.00
	9	0	4	3,285	9.3	56.00	56.00	96.00	36.00	27.00	0.00
	10	0	1	1,095	12.5	16.00	16.00	24.00	12.00	9.00	0.00
	Total.....	10	30	65,700	25.0	$720.00	$720.00	$720.00	$720.00	$720.00	$720.00
*B**	1	1	1	876	10.0	$24.00	$24.00	$24.00	$24.00	$63.90	$72.00
	2	1	2	1,752	10.0	48.00	48.00	48.00	48.00	64.80	72.00
	3	2	3	2,628	10.0	72.00	72.00	72.00	72.00	128.70	144.00
	4	0	3	2,628	10.0	72.00	72.00	72.00	72.00	21.60	0.00
	5	1	6	5,256	10.0	144.00	144.00	144.00	144.00	68.40	72.00
	6	0	2	1,752	10.0	48.00	48.00	48.00	48.00	14.40	0.00
	7	2	4	3,504	10.0	96.00	96.00	96.00	96.00	129.60	144.00
	8	3	4	3,504	10.0	96.00	96.00	96.00	96.00	192.60	216.00
	9	0	4	3,504	10.0	96.00	96.00	96.00	96.00	28.80	0.00
	10	0	1	876	10.0	24.00	24.00	24.00	24.00	7.20	0.00
	Total.....	10	30	26,280	10.0	$720.00	$720.00	$720.00	$720.00	$720.00	$720.00
C†	1	1	1	8,760	100.0	$72.00	$72.00	$24.00	$96.00	$72.00	$72.00
	2	1	2	9,125	52.1	82.67	82.67	48.00	100.00	75.02	72.00
	3	2	3	18,250	69.4	157.33	157.33	72.00	200.00	149.98	144.00
	4	0	3	1,095	4.1	32.00	32.00	72.00	12.00	9.00	0.00
	5	1	6	2,190	4.1	64.00	64.00	144.00	24.00	51.75	72.00
	6	0	2	2,190	12.5	32.00	32.00	48.00	24.00	18.00	0.00
	7	2	4	6,570	18.7	80.00	80.00	96.00	72.00	110.25	144.00
	8	3	4	8,760	25.0	96.00	96.00	96.00	96.00	162.00	216.00
	9	0	4	7,665	21.8	88.00	88.00	96.00	84.00	63.00	0.00
	10	0	1	1,095	12.5	16.00	16.00	24.00	12.00	9.00	0.00
	Total.....	10	30	65,700	25.0	$720.00	$720.00	$720.00	$720.00	$720.00	$720.00

*Results when each consumer is assumed to have the same load factor.
†Results when consumers 1 to 6 inclusive and consumer 10 have the same load factor as in section *A*, but the consumption of consumers 7, 8 and 9 are so changed that consumer 8 has the same load factor as the weighted average load factor of all the consumers.

Two Safe Methods for Allocating Capacity Costs

Used and Unused Capacity Method for Allocating Capacity Costs of a Power Plant to Various Classes of Users

In giving the rules for applying the "used and unused capacity" method, the word "system" is used for a system of a power plant, or a class of a system, or a consumer of a system or class.

1. Multiply the annual, or period, maximum demand of all the "systems" by 8,760 (the hours in a year). The result is the period capacity of all the systems. The period maximum demand of all the "systems," or peak load on the power plant or source of supply, may, however, be used as representing the period capacity. Similarly, each system's period maximum demand represents its period capacity.

2. The kilowatt-hours supplied all the systems is the used capacity of all the systems. The kilowatt-hours supplied all the systems divided by 8,760, or the average hourly load, may be taken as representing the used capacity of all the systems. Similarly, each system's average hourly load may be taken to represent its used capacity.

3. The difference between the "systems'" period capacity and their used capacity is the "systems'" unused capacity. Similarly, the difference between each system's period capacity and its used capacity is its unused capacity.

4. Obtain the ratio of the "systems'" used capacity to the "systems'" period capacity. The result is the "systems'" used capacity ratio.

5. Obtain the ratio of the "systems'" unused capacity to the "systems'" period capacity. The result is the "systems'" unused capacity ratio.

6. Obtain the ratios of each "system's" used capacity to each "system's" period capacity. Each result is the respective "system's" used capacity ratio.

7. Obtain the ratios of each "system's" unused capacity to each "system's" period capacity. Each result is the respective "system's" unused capacity ratio.

8. Multiply the "systems'" capacity ratio (4) by each "system's" used capacity ratio (6) and the "systems'" unused capacity ratio (5) by each "system's" unused capacity ratio (7). Add the respective results. Each respective sum is a "system's" period capacity ratio.

9. Allocate the capacity costs to each "system" by each "system's" respective period capacity ratio (8).

Peak Responsibility and Average Hourly Load Method for Allocating Capacity Costs of a Power Plant to Various Classes of Business

1. Average all user classes' daily peak responsibilities occurring when the maximum station demand is the same for two or more half-hour intervals and then average the daily peak responsibilities of the four largest daily maximum demands occurring in a month and all other demands equal to the smallest of the four largest. The results give the period-peak responsibilities for the month and for the succeeding eleven months unless exceeded. If not exceeded, the thirteenth is the dumping month.

2. If a class has a period-peak responsibility equal to or less than its average hourly load, its average hourly load is its period capacity.

3. If a class has a period-peak responsibility greater than its average hourly load, subtract each such system's average hourly load from its period-peak responsibility. Obtain the ratio of each positive remainder to the sum of all the positive remainders.

4. Multiply the steam plant's unused period capacity by each of the ratios (2). Add to each class product its average hourly load. Each sum is the period capacity of a system as named in item (2).

accurate costs. Columns 8 and 9 show accurate results only when load factors are the same, and columns 10 and 11 are accurate for 100 per cent load factors only. A comparison of the values shown in column 8 with those in columns 6 and 7 shows the inaccuracies of the demand method.

The "used and unused capacity" is the most convenient method for use in allocating capacity costs to systems or classes, because direct ratios for the allocation of the costs can be obtained more easily than by the "consumption and demand" method. The "used and unused capacity" method is not convenient for "selling" capacity costs to consumers, because it involves the differences between the maximum demand and average hourly load. As a result there is an extra cost in billing and a complication in selling the idea to consumers. The "consumption and demand" method is ideal for selling capacity costs of a system or class to the consumers of the system or class, because it involves only kilowatt-hours and maximum demand.

Underlying Principles of Diversity Factor

Mr. Snow states two general principles as follows: "First, that diversity is the result of mutual relationship and is not the property of one class or service; second, that the saving due to diversity may be so awarded at the discretion of the management as to realize the maximum of service with the minimum of expense." The writer would state the two general principles given by Mr. Snow as follows: "First, that the *uncontrolled* diversity is the result of mutual relationship and is not the property of one class of service; second, that the saving due to *controlled* diversity may be so awarded *to those effecting the control*, at the discretion of the management, as to realize the maximum of service with the minimum of expense." The control of diversity is the justification for granting off-peak and seasonal rates.

Mr. Snow states that "overhead expenses and fixed charges cannot be definitely and indisputably assigned, but must be prorated on some more or less arbitrary basis" and that "Dr. John Hopkinson advanced the general theory that these classes of expenses should be prorated in proportion to demand." Now, if by "overhead expenses and fixed charges" is meant capacity expense or cost, the writer must disagree with the statements of both Mr. Snow and Dr. Hopkinson, because I have proved that capacity cost can be definitely and, except by an utter disregard of facts, indisputably assigned with the same degree of accuracy as appertains to meter records. If by "overhead expenses and fixed charges" is meant all investment expenses, then I can, to a certain extent, agree with Mr. Snow that all investment expenses and all operating expenses or total costs cannot be definitely and indisputably assigned to capacity cost, energy cost and consumer cost—the three measurable elements—but must be prorated in some more or less arbitrary basis.

However, I believe the difficulties that are generally thought to exist in finding a definite way to assign expenses to the three measurable cost elements are greatly exaggerated. A few round-table discussions among persons experienced in the matter and possessing analytical minds would reduce divergent opinions to a practical unanimity. The costs that must be prorated by arbitrary methods would be so small in com-

parison with the total costs that a commercially accurate apportionment of costs would result. Any cost created for the purpose of producing, transmitting, distributing and selling electricity should be capable of such an analysis as will disclose quite accurately whether the cost was created (1) for providing capacity for the production, transmission and distribution of electrical energy; (2) for the production of electrical energy; (3) for the definite use of consumers without regard to capacity or energy required; (4) for general management of all other expenditures. The general management cost is, of course, a function of each dollar spent in the costs of the three measurable elements, and although apportioned to them on the dollar method, the basis should not be classed as arbitrary. Possibly the extra cost of so classifying expenses that they could be assigned to one of the measurable elements would be more than the refinement is worth, so that in practice a resort to what might be called arbitrary apportionments of a few accounts should be permissible as well as comparatively easy.

POWER-FACTOR PROBLEM

In addition to the problems of assigning costs to each of the three measurable cost elements and of equitably and accurately allocating capacity costs of consumers, there is the power-factor problem that must be considered. With the problems of determining what are capacity costs and how they can be accurately allocated to systems satisfactorily solved, the equitable apportionment of capacity costs among systems with different power factors must be solved or an unjust burden will be placed on systems with power factors higher than the weighted average of all the systems. There are at least three ways in which this problem can be solved:

1. By the use of kilovolt-ampere demand meters on less than unity power factor loads.

2. By such co-operation among rate-making bodies, utilities, manufacturers and consumers as will result in the installation of such power factor corrective equipment, where necessary, as will maintain the power factor of each consumer approximately at unity.

3. By prohibiting the use of any translating device with less than approximately unity power factor unless power factor corrective equipment is provided.

Output 14.5 per Cent Over Last Year

Generation of 68,500,000,000 Kw.-Hr. Indicated for 1926—March Revenue 4.9 per Cent Above Estimated Normal

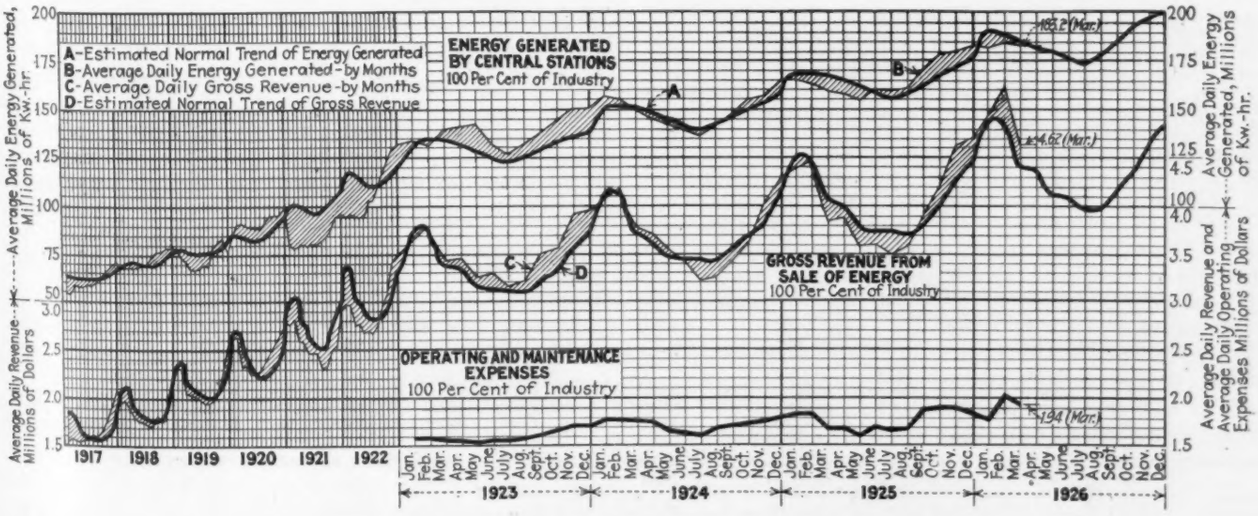
THE amount of energy generated by the electric light and power systems of the country during March totaled 5,679,089,000 kw.-hr., a daily average of 183,500,000 kw.-hr., or 14.5 per cent over the amount reported for March of last year. This output, however, was 0.8 per cent under the estimated normal for the month, this normal being based upon the operations of the past five years. The output of the central-station industry has been under the estimated normal since last December.

The energy generated by the central stations of the country during the first quarter of the year totaled 16,549,082,000 kw.-hr., or 12.5 per cent over the amount reported for the first quarter of 1925. If this rate of increase is maintained throughout the remainder of the year, the output for 1926 will total close to 68,500,000,000 kw.-hr. General industrial activity, however, has been materially above normal since the opening of the year, and the indications are that this activity will decrease as the year unfolds, resulting in decreased electrical energy requirements. It is doubtful if the total energy generated during 1926 will exceed 65,000,000,000 kw.-hr.

The gross revenue from the sale of energy during March was $143,000,000, a daily average of $4,620,000, or 14.4 per cent above the revenue reported for March of last year. This revenue figure was 4.9 per cent above

TABLE I—OPERATING RATIO OF CENTRAL-STATION COMPANIES

Month	Operating Ratio					
	Steam Plants		Hydro Plants		Combined Hydro and Steam Plants	
	1925	1924	1925	1924	1925	1924
December.....	45.6	45.8	26.0	27.4	41.8	44.0
	1926	1925	1926	1925	1926	1925
January.....	45.2	45.3	25.0	26.0	41.3	43.4
February.....	41.3	43.4	34.1	28.9	39.8	40.5
March.....	42.0	44.0	30.0	29.0	40.0	40.5


A-Estimated Normal Trend of Energy Generated
B-Average Daily Energy Generated-by Months
C-Average Daily Gross Revenue-by Months
D-Estimated Normal Trend of Gross Revenue
ENERGY GENERATED BY CENTRAL STATIONS
100 Per Cent of Industry
GROSS REVENUE FROM SALE OF ENERGY
100 Per Cent of Industry
OPERATING AND MAINTENANCE EXPENSES
100 Per Cent of Industry
Average Daily Energy Generated, Millions of Kw.-hr.
Average Daily Revenue, Millions of Dollars
Average Daily Revenue and Average Daily Operating Expenses Millions of Dollars
182.2 (Mar.)
144.2 (Mar.)
19.4 (Mar.)
1917 1918 1919 1920 1921 1922
1923 1924 1925 1926

SEASONAL DECREASES IN OUTPUT AND REVENUE RECORDED DURING MARCH

TABLE II—GENERATION AND DISTRIBUTION OF CENTRAL-STATION ENERGY IN THE UNITED STATES
(100 per Cent of the Industry)

Month	Kw.-Hr. Generated Monthly *			Estimated Distribution of Energy Generated										Energy Purchased by Public Utilities for Resale, Kw.-Hr.	
				Total Energy Consumption by Central-Station Customers, Kw.-Hr.		Energy Consumed for Lighting, Kw.-Hr.		Energy Consumed for Power, Kw.-Hr.		Energy Sold to Electric Railways, Kw.-Hr.		Energy Used in Intracompany Business, Including Line Losses, Kw.-Hr.			
	1925 Thousands	1924 Thousands	Per Cent Inc.	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands
December..	5,719,867	5,101,792	+12.1	4,616,867	4,117,792	1,258,000	1,176,000	2,808,867	2,404,792	550,000	537,000	1,103,000	984,000	1,030,000	697,500
	1926	1925		1926	1925	1926	1925	1926	1925	1926	1925	1926	1925	1926	1925
January...	5,683,055	5,121,776	+11.2	4,586,055	4,133,776	1,260,000	1,168,000	2,771,055	2,429,776	555,000	536,000	1,097,000	988,000	1,015,000	697,000
February..	5,186,938	4,621,235	+12.4	4,184,938	3,729,235	1,128,000	1,044,000	2,555,938	2,201,235	501,000	484,000	1,002,000	892,000	987,000	683,000
March.....	5,679,089	4,963,857	+14.5	4,583,089	4,008,857	1,212,000	1,123,000	2,816,089	2,349,857	555,000	536,000	1,096,000	958,000	1,145,000	760,000

* Data on "energy generated" are those collected and published by the United States Geological Survey for all public utilities minus such data as are collected on energy generated by electric railway companies, reclamation service and manufacturing plants. The data are, therefore, for the electric light and power industry only.

TABLE III—CENTRAL-STATION FINANCIAL OPERATIONS FOR THREE MONTHS IN THE UNITED STATES
(100 per Cent of the Industry)

Month	Total Gross Revenue from Sale of Energy†			Estimated Distribution of Gross Revenue								Total Operating and Maintenance Expenses‡	
				Lighting Customers		Power Customers		Electric Railways		Other Public Utilities			
	1925 Thousands	1924 Thousands	Per Cent Inc.	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands
December	$145,600	$128,700	+13.2	$95,200	$92,000	$36,700	$25,400	$4,800	$4,770	$9,300	$6,530	$59,100	$55,600
	1926	1925		1926	1925	1926	1925	1926	1925	1926	1925	1926	1925
January..	150,500	137,700	+ 9.2	98,300	91,600	37,800	34,170	5,120	5,210	9,280	6,720	59,300	55,700
February.	146,000	129,400	+12.7	94,300	84,600	37,200	31,400	4,820	4,600	9,680	8,800	57,200	51,800
March....	143,000	125,000	+14.4	91,500	81,700	37,000	30,100	4,860	4,700	9,640	8,500	60,100	53,800

† Aggregate gross revenue from actual consumers, and sales to other public utilities for resale, involving a certain amount of duplication.
‡ Do not include interest, taxes, depreciation or sinking fund.

the estimated normal for the month. During the first quarter of the year the revenue totaled $439,500,000, an increase of 12 per cent over last year. If this rate of increase is maintained during the remainder of the year, the revenue for 1926 will total $1,660,000,000, as against $1,484,000,000 in 1925. It is probable, however, that the revenue for 1926 will not exceed $1,600,000,000.

Of the total revenue, it is estimated that $91,500,000, or 64.0 per cent, was received from residential light and power, commercial light and power and street-lighting customers; $37,000,000, or 25.9 per cent, from industrial power customers; $4,860,000, or 3.4 per cent, from electric railways, and $9,640,000, or 6.7 per cent, from other utilities which purchased energy for resale purposes.

The general industrial prosperity of the nation is well reflected in the large increase in the amount of energy sold by the central stations of the country to industrial power customers. During last March 20 per cent more energy was consumed by power customers than during March of last year, and the ELECTRICAL WORLD industrial activity figures for the same month showed an activity of 16.4 per cent above the average activity for the past three years. There appears to be no doubt but that monthly electrical energy consumption by manufacturing establishments is destined to become one of the leading barometers of national and sectional industrial conditions. A barometer of industrial activity must be sensitive as to industrial operations; it must be diversified as between primary industries, and it must be timely. It is believed that a barometer of industrial activity based upon central-station energy sales to power customers possesses these three qualifications to a very high degree. This fact is indicative of the extent to which the electric light and power industry has intertwined itself into the very economic structure of the nation. The central station is today an essential part of American industrial life.

Edison-United Has 729,206 Customers

OUR attention has been called to the fact that the number of customers on the lines of the Edison-United Companies of New York City as given in the supplement to the ELECTRICAL WORLD of April 24 was incorrect. The correct figure is 729,206. The figure as given in the supplement omitted the meters of the United system. The corrected figure for consumption per customer during 1925 (not including railways and other utilities) was 1,793 kw.-hr.

TABLE IV—OPERATIONS OF CENTRAL-STATION HYDRO AND FUEL PLANTS IN THE UNITED STATES *
(100 per Cent of the Industry)

Month	Energy Generated						Fuel Consumption								
	Hydro Plants			Fuel Power Plants			Coal			Oil			Gas		
	1925 Thousands of Kw.-Hr.	1924 Thousands of Kw.-Hr.	Per Cent Increase	1925 Thousands of Kw.-Hr.	1924 Thousands of Kw.-Hr.	Per Cent Increase	1925 Short Tons	1924 Short Tons	Per Cent Increase	1925 Barrels	1924 Barrels	Per Cent Increase	1925 Thousands of Cubic Feet	1924 Thousands of Cubic Feet	Per Cent Increase
December..	1,946,949	1,724,970	+12.8	3,767,118	3,376,822	+11.7	3,350,689	3,173,141	+5.6	761,140	1,328,668	—42.7	3,671,437	2,940,598	+24.7
	1926	1925		1926	1925		1926	1925		1926	1925		1926	1925	
January....	1,928,775	1,676,536	+15.0	3,754,280	3,445,240	+ 8.9	3,272,761	3,230,153	+1.3	972,131	1,329,855	—26.8	3,661,363	2,898,225	+26.3
February...	1,882,758	1,725,877	+ 9.1	3,304,180	2,895,358	+14.2	2,888,369	2,741,313	+1.6	687,760	959,595	—28.5	3,331,111	2,457,463	+35.6
March.....	2,220,065	2,009,222	+10.4	3,459,024	2,954,635	+17.0	3,052,109	2,754,265	+10.7	679,533	791,496	—14.1	3,876,400	3,214,656	+20.6

* As collected by United States Geological Survey. The data are for the electric light and power industry only.

Profitable Load Building

An Interview with
W. H. BLOOD, Jr.
of Stone & Webster, Inc., Boston

EFFICIENT sales service is today one of the most vitally important factors in successful utility operation. According to W. H. Blood, Jr., profitable load building is the key to sound business development, and the measure of capable management is rapidly becoming expressed by what might be called its economic index. To a representative of the ELECTRICAL WORLD at the Atlantic City convention Mr. Blood pointed out that the older commercial methods are unable to meet the strain of economic pressure now being put upon the industry and that the time is ripe for selective load building with a clear comprehension of its needs and opportunities.

"I have just come from the Virginia convention of Stone & Webster managers," said the well-known past-president of the N. E. L. A., "and it is significant that the single topic of our meetings was profitable load building. The emphasis upon this subject at Atlantic City again brings the matter before the national footlights, so to speak, and before the play ends we shall see many new and interesting figures contribute to the profit and to the enjoyment of our industry."

"What is the weakest spot in the central-station armor at present?" asked the ELECTRICAL WORLD man.

"From my observation of the many public utilities which I have examined in past years," said Mr. Blood, "I believe that the business-getting end is the least strong. Most of our utilities today have reasonable financial structures, they are active in employee and customer ownership, their public relations are good, the engineering and construction of their plants is, as a rule, satisfactory, but when it comes to getting profitable business, that is where most of them fall down. The vital question before us is how we shall best take on profitable business.

"To answer this question, many factors must be considered. To recommend the building of new power plants and the running of lines all over the country, so as to take on new business on the basis of $1 gross earnings for every $6 or $8 of capital expenditure, is easy enough, but where does that get one? Much better is it to spend the same amount of effort in getting business along established distribution lines where little or no capital expenditure is required. We turn our capital on an average perhaps once in five years. If we can reduce this period to two or three years, it will put every one of our companies 'on Easy Street.' It is no idle dream to look forward to soon trebling the earnings on some of our present lines with practically no capital expenditure."

"Do you think, Mr. Blood," asked the interviewer, "that load curves should have closer study from commercial men?"

"Most assuredly," replied Mr. Blood. "The hills and valleys of a load curve bring pain to the conscientious operator because of the realization that they mean high-cost demands followed by hours of unused investment. It is not an impossibility to reduce the power peak on a generating plant. In our desire to give the service which our power customers have demanded it is possible that our own interests may have been overlooked. Must our customers have power at the time of our peak? Cannot the time at which they use their loads be shifted? By intelligent effort it has been done. It can be done again.

"Over 20 years ago peak loads in Montreal were reduced by persuading certain large mills to start earlier in the morning and close an hour or so earlier. In 1918 the Public Service Company of New Jersey, being short of capacity, canvassed its larger power users and reduced the peak load in one zone by 10,000 kw. and in another by 1,500 kw. with no curtailment in energy sold. Owing to the educational work of power engineers, the daily load factor was increased from 60 per cent to 97 per cent in three years."

Referring to the question of rates, Mr. Blood emphasized the importance of maintaining adequate charges and prices for service. "In the past," said he, "power rates made to fit special conditions and to meet imaginary competition have almost ruined some otherwise good companies, and there are, unfortunately, still some salesmen who think that price is the only criterion in closing a contract. Service should be sold on the basis of merit, not of price; one does not retain a lawyer because he is cheap. His services, if satisfactory, are generally worth all they cost. With a fair and flexible schedule of rates, maintained by a company with a good reputation and with salesmen of pleasing personality who know their business and the business of their prospects, all the power in the community should eventually be connected to central-station lines as profitable loads."

"In building up a balanced load structure, Mr. Blood, what other classes of business would you seek to develop intensively?"

"It hardly seems urgent to dwell on the necessity of securing lighting loads," he replied. "The superiority of electrical illumination is today self-evident, but a good salesman can be a great help to a customer and add to company earnings by seeing to it that plenty of outlets and lamps of ample candlepower are installed, never forgetting the importance of filling empty sockets. The street-lighting field, with its off-peak advantages, has hardly been scratched. Most residential districts are as dark as Egypt. And finally, I need not emphasize the wonderful possibilities of the American home as a potential consumer of energy. Modern household electric devices are here to stay and to lessen the burdens of homemaking for all time. The importance of this new business demands the attention of the best men in the industry, and it may be that we should seek expert merchandising talent from outside our own industry. We must drive home to the rising generation the advantages of electricity and encourage diversified applications of our service in every department of business, industrial and social life."

Letters from Our Readers

Group Versus Individual Drive

To the Editor of the ELECTRICAL WORLD:

What kind of motor drive to use—group, individual or combination—is like many other engineering problems; there is no universal right answer. Not for a minute do I think that group drive is a thing of the past, although I am unquestionably in favor of individual motor drive in many places. Its value was well proved in a large manufacturing plant where it was my duty to make arrangements for changing in a comparatively short time two thousand individual motor-driven machines from a plant layout designed to manufacture "Liberty" aëroplane motors to one for the manufacture of high-class automobiles. It would have been impossible, at any expense within reason, to make the complete change in layout, as was actually done, if it had involved group drive or general line-shaft distribution of power.

Even with this experience in mind, I cannot feel that promiscuous use of individual motor drive is always best. It is more a question of the use of the machines. For instance, in most brick-manufacturing plants we find it desirable to use group drive for machines that must start or stop together. The same statement could be made of certain mining operations. Wherever a group of machines must be operated as a unit it becomes a real problem to decide whether individual or group drive should be used. Other things, such as light, efficiency, hazard, gear conditions, etc., being equal, I believe that the group drive is generally the most fitting where the machines are to operate together. Power factor and utilization of investment are also very important factors to consider.

This is another case in which the power sales department acts as the customer's consulting engineer. The proper motor drive to use is one of the most important questions that come up for the attention of the utility company. The best brains of the industry should be used on the problem without making any sweeping decision that one or the other is best in all cases.

E. A. ARMSTRONG,
Power Engineer.

Public Service Company of Northern Illinois,
Chicago, Ill.

Obstacles to Development of Sign-Lighting Business

To the Editor of the ELECTRICAL WORLD:

In the March 20 issue of the ELECTRICAL WORLD (page 606) I notice an article, "Sign-Lighting Business Untouched," by K. P. Goewey. Mr. Goewey's article, I think, touches more on the ideal than the practical side of the electric sign question. Having myself been in the game as a contractor-dealer several years and having also some experience with central-station management, I will agree with Mr. Goewey that electric sign advertising is essential—as indispensable as newspaper advertising. But there are obstacles with which to contend.

First of all is the lack of co-operation between the sign manufacturer and the dealer. It is immaterial whether the dealer is a central-station company or an electrical contractor-dealer. After you have interested a prospective customer it may take a month or six weeks to find out the cost and other details concerning the sign he desires. By that time his interest has started to decline, and it is hard, if not impossible, after obtaining the information from the manufacturer to close the deal. This is particularly true in towns with fewer than 20,000 inhabitants.

Then the discounts offered by the sign companies are not enough to justify a contractor-dealer in handling them, and the central-station companies can handle them only from the viewpoint of load building. These discounts are nearly counterbalanced by the overhead charges for handling unless the latter are compensated for by installation charges. It will also be found that there are fewer central-station companies in the electrical merchandising business than there are companies that get behind the contractor-dealer and depend on him to furnish the load. In my estimation, when the sign companies standardize their product and put it on the market the same as other electrical merchandise there will be considerable change in the volume of electrical sign business. That will come about only when we have full co-operation between manufacturer, central-station companies and contractor-dealers.

The above are my views, based on experience, and I should like very much to have others recount their experiences, as electric sign advertising is essential to the merchant and should be a source of revenue to the contractor-dealer as well as to manufacturers and central-station companies.

F. L. EAKIN.

Safford, Ariz.

The A.S.T.M. 30 per Cent Rubber Specification

To the Editor of the ELECTRICAL WORLD:

Despite the fact that the manufacture of rubber-insulated wire extends backward over a period of almost fifty years, the development of new insulating compounds has received more impetus in the last two or three years than ever before. This has been somewhat forced of late by the high price of rubber and the consequent necessity for the use of rubber substitutes, by the increasing demand for rubber-covered wire, which has necessitated in some instances more intensive use of vulcanizers with quicker cures by the use of accelerators, and by the demands of ignition service for a relatively soft compound fairly resistant to the action of ozone at potentials of 7,500 volts and more. There has been much recent and valuable study, also, of oxygen-resisting compounds and of compounds which will withstand rough mechanical usage and abrasion.

In spite of all this valuable development, we have clung religiously to a chemical specification which was written in 1914, and we have attempted to specify the use of this compound as the "best and only" all-purpose compound. Let us see where this position leads.

The 30 per cent dry mineral compound of the A. S. T. M. has one advantage in that it is easily analyzed chemically. We can definitely limit the amount of free sulphur, which is advantageous no doubt, and we can limit the amount of total sulphur, which is not always advantageous. We can determine that 30 lb. of Heavea or Para has been actually put into the compound, although sometimes a far better compound could be obtained by the use of rubber in varying amounts, and we can determine that the vulcanization is complete, although physical tests will give us analogous results. The results obtained, to be sure, give us a check on the probity of the manufacturer, but, on the other hand, they utterly ignore the fact that the manufacturer is keen for future business, and because he is spending

thousands of dollars every year on research he is in a better position to know what a good compound is than is the consumer, and, worst of all, it prohibits the use of many ingredients of great value in compounding.

Mineral rubber, particularly that made from gilsonite, is a very valuable rubber substitute when used in quantities up to 15 per cent, and gives a homogeneity and resilience to the compound not obtained by the use of dry minerals alone. The sharp crystal structure of the whiting is toned down, the dielectric strength is improved, the physical characteristics are improved, and the life of the compound is longer. Replacement of a portion of the smoked sheet by mineral rubber decreases the water absorption of the compound and increases the resistance to attack by ozone. The only objection to its use is that it interferes with the 30 per cent dry mineral-compound analysis by increasing the acetone extract, chloroform extract and apparent rubber content. On the other hand, the specific gravity is lower, the coverage is consequently greater, and appreciable saving in cost can be effected by its use.

Petrolatum, linseed and palm oil and some of the resins facilitate tubing and cheapen the cost of the compound through increasing production. They also improve the homogeneity of the compound when judiciously used and have a greater solubility in rubber than even mineral rubber. One of our best American compounds, both for ozone resistance and life, has a relatively small percentage of rubber and a large percentage of vulcanized oils.

Carbon is an excellent substance and when used in small amounts increases the toughness of the compound without appreciable loss in dielectric strength. The research of Messrs. Bierer and Davis of the Boston Woven Hose Company has shown that replacement of a small amount of zinc oxide by carbon gives increasing toughness and an equivalent conductivity of heat.

As regards the use of carbon in the protective jacket of super-service cords, one manufacturer tells us that he tested the cords of four manufacturers by stringing them across an alley where for a whole winter they were run over by heavy trucks and teams. As they showed no signs of wear, he took them to a neighboring mine and strung them across the tracks, where trains of mine cars ran over them without appreciable injury. They were finally broken down by being run over by a 20-ton locomotive.

Now, while it is not suggested that every manufacturer equip himself with a 20-ton locomotive as a part of his testing apparatus, we believe that more rigorous methods of abrasion testing are in order than those now in use, and as a result it would not be surprising to see in the near future, perhaps, a tree wire strip-insulated with $\frac{3}{64}$ in. of a good dielectric stock covered with $\frac{3}{64}$ in. of a stock containing from 18 to 22 per cent of carbon, a slight excess of sulphur, a filler of seine twine and a proved anti-oxidant and *no loom braid* —a cheaper and better tree wire than we have today.

The use of shoddy is barred, and research shows that a compound is actually improved by the use in proper proportions of a good tire shoddy. One chemist likens it to the reinforcement in concrete, giving backbone to the compound.

The accelerator group are too important to ignore. They are coming more and more into favor in the rubber industry not only as time savers in vulcanizing but for their other excellent properties. They give a "flat" cure, decreasing the importance of the time element in vulcanizing, and by evening up inequalities in the compound they insure a more uniform product. They improve the physical properties, give a longer and more uniform aging and decrease the power factor and dielectric constant. Moreover, many of them at least have a certain value as anti-oxidants.

Selenium is another toughener when used with sulphur and would be barred by strict adherence to the A. S. T. M. specifications. Lastly we come to the comparatively new group of anti-oxidants which increase the life of the compound from 500 to 600 per cent. Are we to ignore them entirely?

In the purchase of coal or oil or electrical machinery or paper cable we do not presume to dictate structural or chemical specifications, but leave that to the engineers of the manufacturers, and we buy on performance alone. Why not purchase rubber-covered wire on the same basis? The Bierer and Davis oxygen-aging test is fast supplanting the Greer test as an excellent criterion of "expectancy of life." We have adequate physical and electrical tests, and suitable tests for resilience, penetration and abrasion are being developed. The conservative specification is good, but eternal progress is "more to be desired than much fine gold."

Public Service Production Company,
Newark, N. J. ROBERT J. LONG, JR.

Photographic Evidence on Highway Lighting Held to Be Misleading

To the Editor of the ELECTRICAL WORLD:

In your April 17 issue (page 816), an article on "Comparisons Between Lighted and Unlighted Highways" appears in which the comparisons have been made by photographs, equally timed, and conclusions drawn solely from the evidence. Such photographs are entirely misleading for two reasons: First, no photographic film can even approximate the range of light sensitivity of the human eye; second, the photographs are taken with equal exposures, whereas the diaphragm of the eye adjusts its sensitivity to the volume of light. The result is that where the photograph film shows increased vision, the actual result is frequently decreased vision, resulting from the contracting of the pupils when facing unshielded light sources of road illumination.

Surely every driver of an automobile has experienced the relief which comes, in night driving, when he passes beyond the sparsely illuminated streets of the outlying residence district on to the country highway, unlighted save by his own headlights. Vision which, facing the glare of unshielded street lights, strove in vain to penetrate the darkness just beyond the light, becomes more far-reaching immediately, as the pupils expand when relieved from the nerve-racking glare against which they have contracted, to protect the nerves of the retina.

For the reasons stated I maintain that every conclusion in the article mentioned which is based on the photographic evidence presented is erroneous. If we are to have lighted highways, it is imperative, first, that the sources be entirely concealed or mounted so high as to be above the range of the motorists' vision; second, that they be spaced sufficiently close to illuminate all the highway and to make headlights unnecessary. Unconcealed lamps of 200 cp. spaced 250 ft. apart materially increase the hazard of night driving and reduce the safe driving speed. Wholly concealed lights placed on short curves and turns of the highway, on the other hand, would undoubtedly be an excellent safeguard.

L. D. ROWELL,
Associate Professor of Electrical Engineering.
School of Electrical Engineering, Purdue University,
Lafayette, Ind.

Central Station and Industrial Practice

Boiler-Room Work Record Stimulates Sporting Spirit

SOMETIMES boiler-room records are obnoxious to operators, because the latter do not recognize their value and because they think they are only a check on themselves. But properly planned and maintained records can be of considerable assistance to the men who keep them in so co-ordinating their work that the best results are obtained with the least effort. Such records enable better scheduling of work, checking work against schedule, better visualization of conditions than figures, making up operating report, ascertaining previous work done without verbal transmission of information and the possibility of omissions.

Such a record is employed by the boiler-room foremen of the Philo station of the Ohio Power Company with great satisfaction not only to themselves but to the boiler attendants because it stimulates a sporting spirit.

The record is simple, being plotted on 10x24-in. cross-section paper, which is posted on the boiler foreman's office wall. This sheet accommodates two months' activities, but records for six to eight months back are kept posted for reference. The remainder are filed.

On these sheets, dates serve as abscissas and boiler numbers as ordinates. Letters and colors serve as the legend. Both service records and work records are kept on these sheets. They show, by horizontal lines, the boilers in service or available and those out of service with the period thereof. The causes of outage are indicated as follows: B, banked; C, changed water; S, slagged; E, economizers; B. T., boiler tubes; G. R., general repairs; O, economizers blown with air; P, preheaters blown with air.

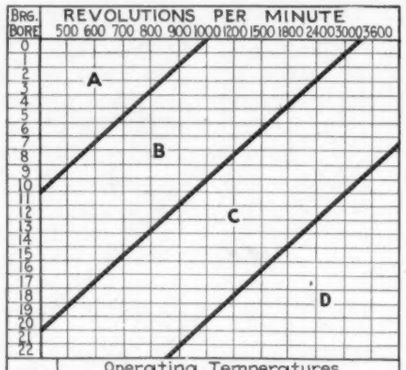
Operations that must be performed regularly are scheduled by shift, such as tube slagging, ash grinding and soot blowing.

The necessity for changing water is determined by chemical analysis and a predetermined allowable limit to chemical constituents; the tube slagging by visual observation and draft-gage readings; economizer cleaning (done when boilers are out of service) by temperature drop in service and visual observations out of service; repair of economizers by observation of leaks; boiler-tube maintenance by visual and audible indication and temperature drop; valve and joint maintenance by visual and audible indication; furnace and casing maintenance by visual observation; superheater tube maintenance by visual and audible indication; air preheater cleaning by temperature drop; back-wall slagging (when in service) by visual observation; side-wall slagging (when out of service) by visual indication.

Lubrication of Ball Bearings in Electric Motors

BY C. W. RAUCH
Assistant Chief Engineer Standard Steel & Bearings, Inc.
Plainville, Conn.

OILS and greases in combination with babbitt, bronze, brass and other soft bearing metals have had wide application in the mechanical arts for many years. The considerations involved in the lubrication of annular ball bearings, however, are of an entirely different nature from those involved in plain bearings, due to the fact that in ball bearings there is an actual contact of balls and race grooves.



GROUP	Operating Temperatures: Below 32 Deg.	32 to 150 Deg.	150 to 200 Deg.
A	Low-temperature oil or low temperature grease	Medium oil or No. 2 or No. 3 grease	Heavy oil or high temperature grease
B	Low-temperature oil or low temperature grease	Medium oil or No. 2 grease	Heavy oil or high temperature grease
C	Low-temperature oil	Light or medium oil or No. 1 or No. 2 grease	Medium oil
D	Low-temperature oil	Extra light or light oil or No. 1 grease	Medium oil

LUBRICATING CHART FOR BALL BEARING ELECTRIC MOTORS

The lubricant, however, whether oil or grease, has four distinct functions to perform in an annular ball bearing. They are:

1. To prevent friction between balls and ball retainer pockets. This is especially important at high speeds.
2. To prevent rust or corrosion on the highly polished surfaces of balls and grooves.
3. To form a supplementary seal between rotating shaft and stationary housing, preventing the entrance of dirt, water, grit or foreign matter. This feature is especially helpful after initial felt or other style of seals have become worn from a long period of service.
4. To act as a medium for carrying away and dissipating any heat generated by ball contact.

Thus a lubricant in a ball bearing, even though acting in a supplementary capacity, is a big factor in keeping it in its original perfect condition and is, in effect, real "life insurance" against premature failure.

LUBRICATION FACTORS

A ball bearing permits a fairly wide latitude in regard to selection of lubricant, whether oil or grease, or whether of high, medium or low viscosity. Nevertheless it is desirable to use a grade of oil or grease best suited to the particular conditions under which the bearings operate. Oils of different viscosities, non-fluid oils and soft greases (generally designated as No. 1 or No. 2) are suitable. Hard greases are not adapted to use of ball bearings, as they have a tendency to channel, leaving the parts unprotected.

Speeds of electric motors vary from about 500 to 3,600 r.p.m. There is no well-defined line between desirability of grease and oil based on speed. In general, however, grease is preferred for low speeds and oil for high speeds; in most cases the

choice is dependent on the type of lubricating system. At high speeds there is considerable fluid friction as a result of the churning action, and therefore a very light oil is necessary to avoid excessive heat and loss of power. At lower speeds heavier bodied oils or greases will be found to be satisfactory.

The factor of shaft size should also be considered, because on this depends the speed of the ball retainer and the surface speed of the balls. The type of housing in horizontal electric motors in general admits the use of either oil or grease, and the designer may provide either grease nipples or oil cups. However, when it is found that existing seals are not oil tight, a simple expedient is to use a semi-fluid oil of a consistency usually designated as "600W." This oil is a fluid at ordinary operating temperatures, but congeals when the motor is idle.

A final factor in determining the proper type of lubricant is the operating temperature, which is generally about 40 deg. above that of the surrounding atmosphere. Bearings in motors subjected to high temperatures should be provided with heavy oils or greases that will be of the proper body at operating temperatures. Motors exposed to subnormal temperatures, such as in refrigerating plants or out of doors in winter in cold climates, should have the bearings lubricated with light oils or greases. It is always preferable where possible to use an oil of such a viscosity or a grease of such a consistency that the lubricant during the running of the motor will neither be so light as to be thrown out of the bearing nor so heavy as to cause excess friction or channeling.

Choice of Lubricants

In choosing among the brands of lubricants made by different manufacturers, the user should be governed largely by the integrity and good name of the maker. The poorer grades of lubricants often break down or fatigue with use or become gummy and hard. Many bearing failures can be traced to a cheap grade of lubricant. One of the characteristics of an inferior grease is a tendency to separate on standing or after a short period of use.

Greases or oils used with antifriction bearings should be very nearly neutral and should not contain more than a trace of free acid or alkali. Even a small quantity has a decided tendency to attack the mirror-like surfaces of balls and grooves, causing rust and corrosion. Only mineral greases and oils are suitable for ball bearings, as it has been found that vegetable oils easily decompose and become rancid and acid. A ball bearing requires such a small quantity of lubricant that it is false economy to use any but the highest grade.

For the convenience of users of ball-bearing-equipped electric motors, there is shown herewith a chart giving recommended specifications of oils and greases for various conditions of temperature, speed of shaft and shaft size. In considering the lubricants of different brands the user can select an oil or grease of the proper specifications in line with the foregoing.

Care and Attention

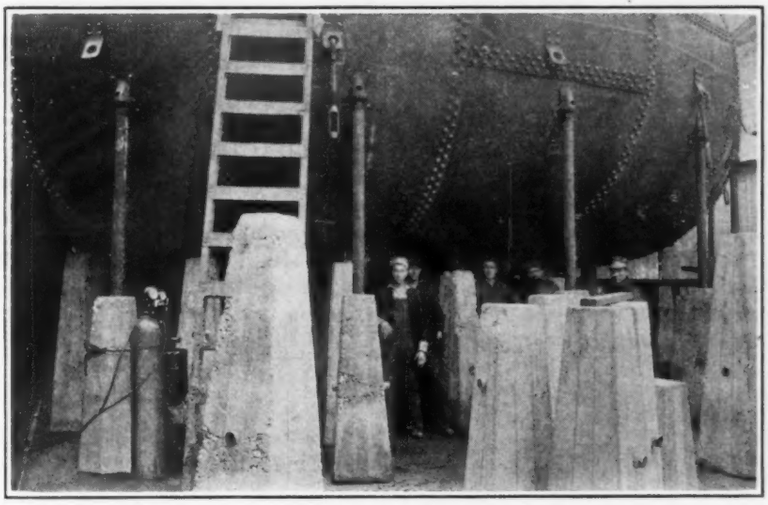
Initial lubrication, which is done by the motor manufacturers, consists of filling the bearing housings about one-quarter to one-half full of grease, or a small quantity of oil to the level of the center of the lowest ball. After an annular ball bearing has been lubricated, it can be left alone for from three to six months and frequently longer. It is not possible to lay down any hard and fast rule on this matter, but there is no doubt that if the correct grade of a pure lubricant is used in a well-sealed housing, replenishment at semi-annual intervals would be sufficient. However, where leakage or entrance of dirt is suspected, it is advisable to lubricate at more frequent intervals and, if necessary, to clean out the housing by removing worn oil or grease.

Where the motor is equipped with a high-pressure system such as "Alemite," "Zerk," or "Dot," the procedure is simple. First wipe the nipples clean, then introduce a small quantity of grease into the housing.

On systems using oil lubrication the amount of oil should be controlled, so that the proper level of the oil is preserved; this feature can be regulated in the design by providing a filler plug. Great care should be taken not to introduce any dirt into the bearing when lubricating.

Supporting Scroll Case During Construction

AN INTERESTING method of supporting scroll cases during construction is shown in the accompanying illustration. This illustration shows one of the cases of the Cherokee Bluffs development of the Alabama Power Company located on the Tallapoosa River. When the scroll case was built, pipes imbedded in concrete pedestals were fastened to the case as shown to keep it in place. Just above these, small straps were fastened, to which turnbuckles are attached with suitable means for fastening to other pedestals. These are to keep the scroll case from rising when concrete is poured around the case.



JACKS AND PEDESTALS FOR SUPPORTING SCROLL CASES

Priming Circulating Pump with Condenser On

AS A means of priming the circulating pump of the condenser on a 20,000-kw. turbine, should the pump be losing its water, M. W. Greenup of the Ohio Public Service Company at Lorain, Ohio, devised and installed a small amount of pip-

ing as shown in the accompanying diagram. At the company's Edgewater plant two condenser air pumps are connected to the same vacuum header. One is a steam jet and the other a turbo air pump. Either of these can be used to prime the circulating pump prior to starting the turbine, providing the vacuum header valve *D* is closed on the line to the condenser.

After the pump has been primed and is pumping water, the vacuum header valve is opened to procure a vacuum on the condenser. While the unit is operating only one air pump is used, usually the steam jet, although in case of trouble the same condition would result with either pump. Should the circulating pump be losing its water under the former arrangement of piping, all that could be done if the pump could not be run fast enough to hold the water would be to shut the condenser down and start over.

By using the arrangement shown in the accompanying diagram the vacuum can be restored to the circulating pump by use of the auxiliary air pump through the pipe line shown as a dotted line in the diagram without interfering with the main vacuum. When the system is running with the ejector valve *D* open, to prime the circulating pump without shutting down the condenser:

Valves *H*, *C* and *B* (which are normally closed) are closed. Valves *G* and *A* are opened. The motor-driven vacuum pump is started, which primes the circulation pump and restores circulation.

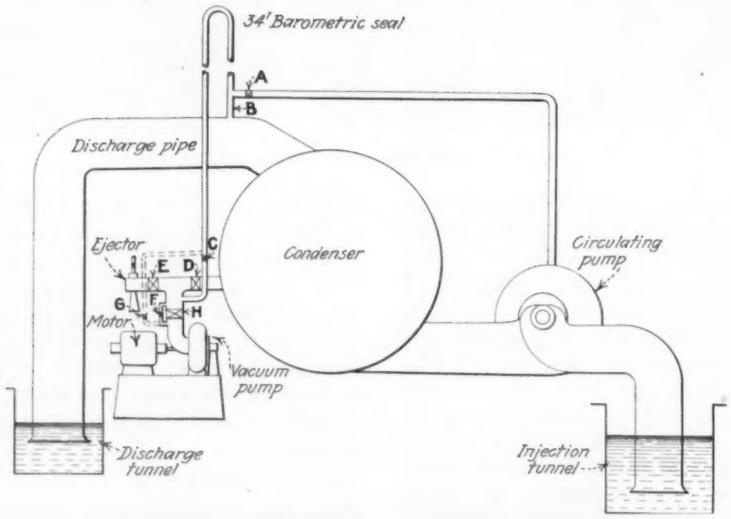


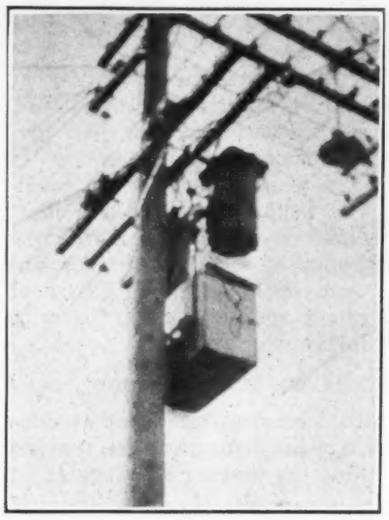
DIAGRAM OF CONDENSER AND PRIMING EQUIPMENT

Dotted line indicates piping installed in line for lifting water with the auxiliary air pump without the use of the main vacuum

Graphic Meter for Testing Transformers

BY THOMAS HUGHES

Superintendent Sheridan County Electric Company, Sheridan, Wyo.



CURRENT TRANSFORMER AND CURVE-DRAWING AMMETER MOUNTED ON POLE FOR TESTING DISTRIBUTION TRANSFORMERS

ACCURACY of results at a minimum of expense has led the Sheridan County Electric Company to discard a split-core current transformer and ammeter and the Wright demand indicator for testing distribution transformers in favor of a current transformer and type U Westinghouse graphic ammeter. The current transformer and ammeter are mounted in a weatherproof box and, suspended from the transformer, rest in the manner shown in the accompanying illustration. The primary leads of the current transformer are brought out of the box so the instrument can be cut in series with the primary of the transformer under test. One or two 100-watt carbon lamps are placed in the box in cold weather to provide enough heat to insure proper working of the graphic meter.

The cost of testing transformers in this manner varies from $1 to $1.50. In the business district the instrument is left on a transformer for a week, whereas in the residential district two or three days is sufficient for a test which will represent average load conditions.

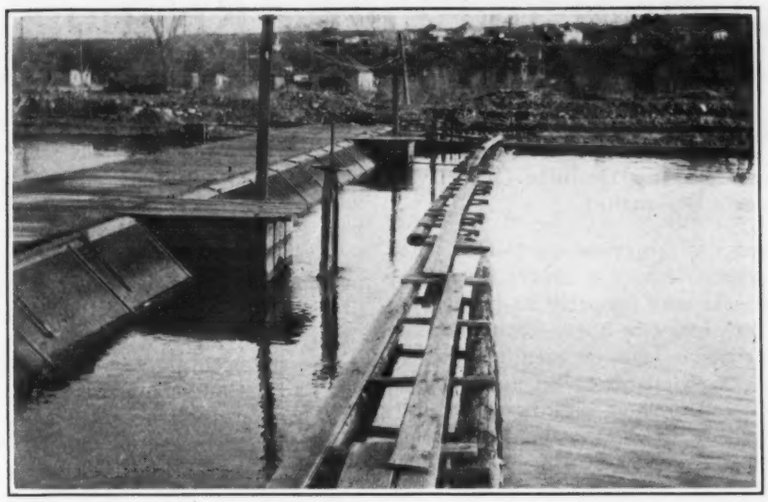
Accident Prevention Value and Inexpensive Methods

ENTIRELY aside from the altruistic spirit of saving human life, on which no tangible money value can be placed, accident prevention cuts down "time out on pay," insurance rates (because based on mortality) and labor turnover, which is very expensive. Besides having these advantages, it avoids demoralization of employees caused by accidents and resulting reduced efficiency and makes the employees feel that a personal interest is being shown them and consequently develops good will.

When the fact is remembered that the ordinarily considered chief contacts with the public represent only 5 to 10 per cent of the employees and that the other 90 to 95 per cent individually have many friends who make up the public, a utility man can well afford to participate actively in accident prevention if for no other reason than to build up the good will of the employees and thus indirectly the good will of the public. These views come from K. R. MacKinnon, general superintendent Nebraska Power Company, Omaha, who has seen the benefits of accident prevention effected in his own company with very little expense.

As tangible evidence of its economic value, Mr. MacKinnon points out that the labor turnover in his line gangs has been reduced from 18 per cent to a negligible value, that lost time due to accidents has been reduced from 1,465 to 157 hours per year, that liability compensation has been reduced from $22,500 to $1,600 per year, all between Jan. 1, 1923, and Dec. 21, 1925. Still, the cost of

Trash Collector Consists of Timber-Faced Logs



TROUBLE with débris, consisting mostly of pine needles sometimes reaching an inch in thickness, clogging the condenser water intake screens at the Canon City steam plant of the Southern Colorado Power Company, has been overcome by placing logs across the settling basin in front of the intake screens in the manner shown in the accompanying illustration and lining the face of these logs with 1x12-in. timbers running lengthwise with the logs. These planks act as a batter board and serve to divert surface trash to a spillway emptying back into the river at one side of the settling basin.

the accident prevention was only $950 in 1925.

The success of the accident prevention movement in Omaha is attributed chiefly to making the foremen responsible for persons under them, and by teaching the employees to think safety until they automatically act safety. A safety committee should be formed of members drawn from each department so that the safety ideas will reach every corner of the organization. The duties of such a committee are suggested in the accompanying outline, as is also the method of arousing a safety conscience among employees.

Suggested Activities for a Safety Committee

Issue Safety Rules.—Fundamental instructions should be incorporated in them, covering such things as the use of rubber gloves, use of intoxicating liquor, discipline while at work, inspection of tools, etc.

Investigate Accidents—Determine causes and recommend methods of preventing recurrence.

Recommend disciplinary measures (if required).

Provide method for receiving suggestions from employees. These suggestions should be replied to individually so the employee suggesting them will know that the committee is interested in his suggestion. If the suggestion is not accepted by the committee, the employee should be told the reason.

Order installation of safeguards up to a certain cost.

Recommend to the management safeguards costing more than a certain amount. Many executives are afraid to start safety work, thinking that employees will call for large expenditures for unnecessary safeguards. Experience shows that this does not happen.

METHOD OF AROUSING SAFETY CONSCIENCE

Foreman Responsibility.—This is the key to safety work. Make the foreman responsible for the safety of his men. This alone, if properly sold to the foreman, will produce wonderful results.

Publicity of Accidents.—Give statistics and show photographs. Tell why an accident occurred and who the man's foreman is. Neither the man nor his foreman will want future advertisement of his carelessness.

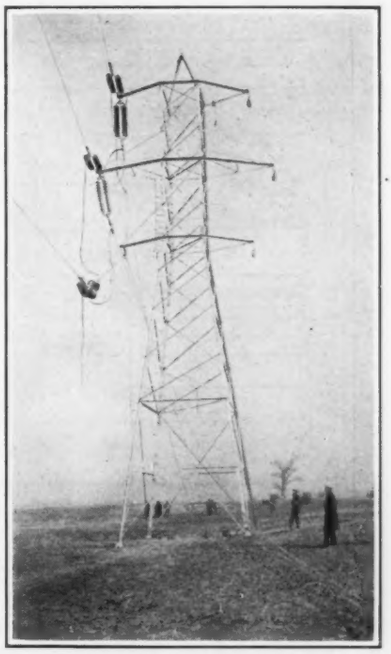
Competition Among Departments.—It may be a certificate of honor, a flag, a banquet or a monthly box of cigars, but some interdepartmental prize will have a stimulating effect in keeping safety before employees. Give them something to work for—they will do it.

Train employees to think safety by means of bulletins, letters, posters, etc. Show them you are interested—that you are thinking safety. They will learn to think and then to act safety.

Attaching Insulators on Strain Towers

BY CHARLES C. HOKE
Union Electric Light & Power Company

CABLE was pulled on the strain towers of the Cahokia-Crystal City transmission line of the Union Electric Light & Power Company by using the winch on one of the regular line trucks. As shown in the illustration, the truck was anchored some distance from the tower with an anchor which would handle the 2,200-lb. strain exerted. The cable was pulled up to tension without insulators attached, was marked at the point on the tower where the insulators were to be hooked on and was then lowered back to the ground. The insulators consisted of two twelve-unit strings of Ohio Brass insulators, yokes at each end, a clevis joint at the top to attach to the hook already on the tower, and a clamp at the bottom. The insulators were clamped to the conductor and the cable was pulled back up to the tower. By means of the clevis the insulators were readily attached to the hook, already placed on the tower, by inserting the bolt, thus eliminating the difficulty of inserting the hook on the tower with the cable and insulators under strain.



METHOD OF ATTACHING INSULATORS ON STRAIN TOWERS

Commercial Activities and Public Relations

Better Service Department Experience

Securing Employees' Co-operation—Establishing Definite Objectives —Experience from Year's Operation

REPRESENTATIVES of the better service department of the Wisconsin Power & Light Company are charged with serving 50,000 customers in southern and central Wisconsin, carrying out the following program: (1) To inquire as to the physical and personal contact between the customer and the company or the company's representatives; (2) to give information to the customer concerning the company's history, plans, projects and policy; (3) to secure information on the attitude of the customer toward the company, whether it is friendly, indifferent or unfriendly; (4) to secure data relative to the ownership of company's securities by the customer, and the need of additional appliances, provided the interview up to this point has been of such a nature that these subjects may properly be broached.

On house-to-house canvass the men make note of results obtained with each customer on an envelope, designed to show the history of each customer to date. Inside this envelope are placed all high bill complaints, trouble tickets, service call reports and better business tickets that relate to this customer. The symbol placed in the square in the upper left corner indicates the customer's attitude. A glance at the symbol shown on the various envelopes will indicate to an executive the conditions of customer relations in a given section of a territory, so far as they can be reflected by the operations of this department. These symbols show whether the customer is friendly, indifferent or unfriendly, and by noting the change in symbols the executive can tell in what territory public relations are improving, in what sections there is little change and where they are unfavorable.

N.W. 125 WEEKLY SERVICE SURVEY REPORT

DISTRICT	TOWN	CUSTOMER	St. Car / Elec.	Water / Heat	Gas / Bus

PERIOD COVERED: From To

Calls	Interviewed	RECORD OF BETTER BUSINESS TICKETS			
		DEPARTMENT	No.	DEPARTMENT	No.
Not Home	Recalls				
Given Information	Not Given Infmtn.				
Found Indifferent	Left Indifferent				
Found Unfavorable	Left Unfavorable	New Business Places Called On:			
Found Favorable	Left Favorable	Company Meetings Attended			
Complaints	Complaints Settled	Public Addresses Given			
Mdse. Prospects	Stock Prospects	REMARKS:			
Appliance Repairs	Taught Meter Reading				
COMPLAINTS ANALYZED:	Settled / Referrd				

Better Service Representative

Approved:

District Manager

Reverse Side of this Sheet May be Used for Additional Remarks.

WEEKLY REPORT OF BETTER SERVICE REPRESENTATIVE

The representatives of the department adjust any complaints of faulty switches or appliances. They have repaired approximately 50 per cent of the articles about which complaint was made, the other 50 per cent being referred to the regular repair department because it was found impossible to make repairs on the premises. Effort is also made to teach as many customers as possible how to read their meters.

CALLING ON NEW CUSTOMERS

In addition to the house-to-house canvass, representatives of the better service department call on new customers moving into their districts. Likewise, when new towns are added to the company's property, men from this department go into the new towns and acquaint the new customers with the history of the company, its policy and rates. This work is done by this department, because it has been found a physical impossibility for the district manager to care for this duty as promptly as is desirable.

An important work done by this department in co-operation with the safety department has been to bring to students in the public schools, more than 55,000 during 1924, the importance of safety and an understanding of what the company is trying to do to make the use of its service safe for its customers and the public. This work has received the fullest co-operation of school principals and teachers and the state superintendent of public instruction.

During the year that the department was still in process of organization, more than 10,000 calls were made, and of these calls only 40 persons were left still feeling unfriendly toward the company. The calls made in answer to complaints of high bills resulted in more than 95 per cent of these complaints being adjusted to the entire satisfaction of

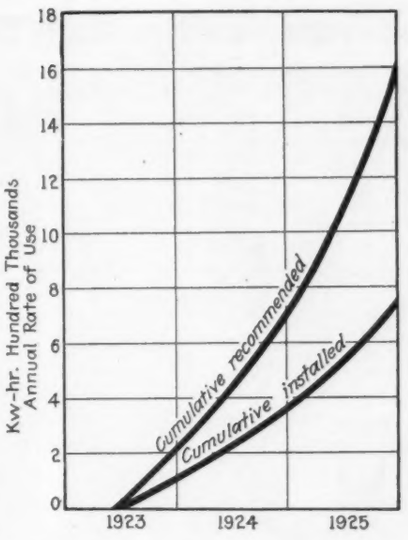
the customer. An important result of this work has been a marked falling off in the number of bill complaints from territories covered by the canvass, one town reporting no high bill complaint.

Results Attained by an Illuminating Department

INTENSIVE cultivation of commercial and industrial lighting business during the past two and a half years by the illuminating engineering division of the commercial and industrial department of Charles H. Tenney & Company, Boston, Mass., has resulted in the installation of new or improved lighting totaling 750 000 kw.-hr. present annual consumption on the utility properties under this management. The estimated revenue from this business is now $45,000 per year, and the growth of this business plotted on a monthly basis is shown on the accompanying chart. The division recommended a total of 1,615,000 kw.-hr. of lighting betterment, representing an annual revenue of $96,900.

During the past 30 months 436 jobs were laid out. The added kilowatt-hours of new business were based on the following hours' use of the connected load per year: commercial lighting, 1,400 hours; factory and industrial lighting, 500 hours; stone shed lighting in quarry districts, 500 hours. The business was obtained by aggressive "direct-by-mail" advertising, by personal solicitation and by recommendations in the form of reports and blueprints of adequate layouts showing how to obtain correct illumination and the benefits derived from it.

During 1925 the division standardized its typewritten specifications, revised its field notes and survey sheets and added many cuts of manufacturers' equipment to standard reports. These enable a more finished set of recommendations to be submitted. The division is now compiling a notebook for field work in lighting. This will contain practically all the standard fixtures with particulars of their characteristics and with tables and charts for laying out lighting. It is planned to make this material available to local utilities and contractors. W. S. Wallace, illuminating engineer, states that increased business can be obtained in this class of work by more active "direct-by-mail" solicitation, by more personal solicitation by competent engineering salesmen; by follow-ups by local central stations of all new building work; by the interviewing of more architects, engineers and contractors under divisional direction, and by the use of the most modern lighting by electric utilities in their own offices, stores and windows. V. M. T. Tallman is manager of the commercial and industrial department of the Tenney organization.

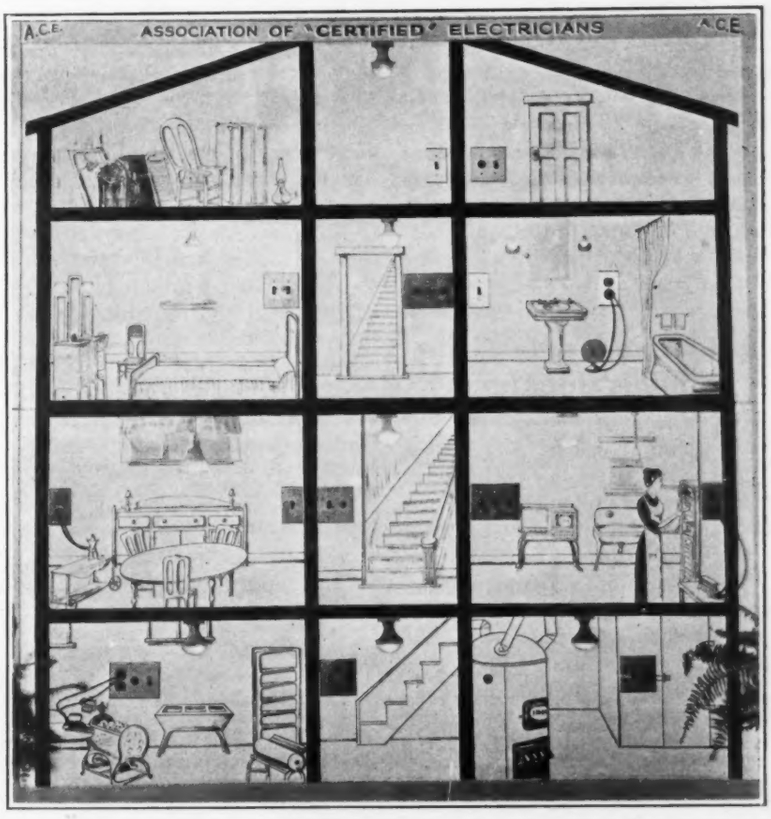


NEW LIGHTING BUSINESS RECOMMENDED AND SECURED

Display Board Encourages Better Wiring

ELECTRICAL exhibits and local industrial shows offer an excellent opportunity for the central-station company and electrical contractors to co-operate in the promotion of better house wiring. At a recent automobile show in Lorain, Ohio, the Ohio Public Service Company, in conjunction with the Association of Certified Electricians, displayed a large board showing the various rooms in a home with proper wiring and switch arrangements that attracted much attention and was particularly valuable as an educational medium.

During the show the electricians' association had a man at the booth who passed out to all children envelopes containing a list of all the rooms in the home with the kind and number of outlets that should be installed according to the specifications of the Cleveland Electrical League. They were instructed to show on each sheet the kind and number of outlets in their homes and on another sheet what additions they would have to make to bring their homes up to the specifications. Any child who brought these answers to the store of any member of the



DISPLAY BOARD SHOWS PROPER HOME LIGHTING

Modern Equipment in New Utility Building

THE United Light & Power Company has recently completed a new headquarters building in Davenport, Iowa, to serve as operating headquarters for itself, the local service company and its operating properties in the states of Nebraska, Iowa, Illinois, Missouri, Kansas, Indiana, Michigan and Ohio. The accompanying illustrations show, on the right, the modern equipment available in the drafting room and, on the left, the chemical laboratory, where scientific analysis makes for greater efficiency.

Twenty-page special sections in the local newspaper preceding the formal opening of the building indicate the public interest in the event and show the appreciation of Davenport people created by the addition of the new building to the downtown section.

association was given a bright new 25-cent piece. The returns have been very encouraging and contractors have obtained a number of prospects for better wiring.

The display board shown in the accompanying illustration is owned jointly by the Lorain Association of Certified Electricians and the Ohio Public Service Company. All the lamps, switches and outlets are wired up and supplied with 6-volt bulbs. Current is supplied from an automobile or radio battery. The switches were arranged to operate the respective lights and a master switch was installed in the main bedroom to control all the lights in the house

Short Course for Meter Men at Johns Hopkins

THE school of engineering of the Johns Hopkins University, Baltimore, Md., in co-operation with the Maryland Public Utilities Association, the Consolidated Gas, Electric Light & Power Company and the Maryland Public Service Commission, is conducting a short course for meter men covering the period from June 1 to June 12. This course is designed not so much to teach the men "how to do the thing" as to give them the reasons for the various operations in metering. Each day of the course will be divided approximately as follows: Morning, three hours to classroom and lecture work; afternoon, four hours in laboratory work; evening, two hours in discussion and practical problem work or outside engineering lectures.

The classroom and lecture work will cover the fundamental facts upon which electrical engineering is based and the principles underlying meters and their operation. Laboratory work will be carried out with the help of all the equipment and facilities of the laboratories of the department of electrical engineering. Among other subjects that will be considered in the evenings devoted to problems, discussions and outside lectures are demand meters and meter test department systems, and lectures will be given by representatives of all the leading meter and instrument manufacturers. This is the third year that this course has been given at Johns Hopkins and the attendance has been rising steadily, the enrollment including not only men from Maryland but some others from nearby states as well.

Rural Electrification in Alabama

THE following information from the department of agricultural engineering of the Alabama Polytechnic Institute at Auburn, Alabama, was supplied to the ELECTRICAL WORLD by E. C. Easter, associate agricultural engineer of the Agricultural Experiment Station of that school:

Number of farms in Alabama (1925)..... (Farm according to census is more than three acres, or less than three acres that produces a minimum gross annual revenue of $250 operated by one man alone or with hired labor paid with wages. Farmer is classified as one obtaining a major part of his income from farming. Includes owners, tenants and shareworkers.)	237,564
White farms.....	152,242
Farm owners.....	92,917
Tenant farms.....	144,199
Number of farms electrified (Jan. 1, 1926):	
From central station.....	453
Farms in reasonable reach of existing rural lines..... (Includes those that are receiving service.)	500
Miles of rural lines, Jan. 1, 1926.....	183.3
Miles authorized or under construction, Jan. 1, 1926.....	167.2
Rural customers Jan. 1, 1926.....	1,880
Additional customers to be served by lines authorized or under construction.....	1,822
Total present and future customers.....	3,702

ENERGY CONSUMPTION FOR SOME USES OF ELECTRICITY ON THE FARM

Operation	Average Connected Load	Energy Consumption
Lighting.....	500 watts	18 kw.-hr. per month
Range.....	7,200 watts	125 kw.-hr. per month
Water pump (household).....	½ hp.	16 kw.-hr. per month
Refrigeration (household).....	½ hp.	50 kw.-hr. per month
Milking.....	2½ hp.	2.5 kw.-hr. per cow per month
Separating cream.....	½ hp.	1.1 kw.-hr. per 1,000 lb. of milk
Threshing.....	7½ hp.	26.0 kw.-hr. per 100 bu.
Feed grinding.....	7½ hp.	6.0 kw.-hr. per ton
Water pump (livestock).....	1 hp.	0.2 kw.-hr. per 100 gal.
Milk cooling.....	¼ hp.	27.5 kw.-hr. per 100 gal.
Filling silo.....	15 hp.	2.4 kw.-hr. per ton
Lighting dairy.....	500 watts	20.0 kw.-hr. per month

Digest of Electrical Literature

Generation, Control, Switching and Protection

Recent Improvements in the Insulation of Electrical Machinery.—A. E. MAXWELL and ALLEN MONKHOUSE.—This is a review indicating the more recent developments in the manufacture and use of insulating material. A survey of the prominent characteristics of such material is followed by a summary of process improvements. In handling this subject the authors put forward a strong plea for standardization of nomenclature and of test methods for determining the essential properties of insulating material. The paper is accompanied by eight appendices which include examples of standardizing of material terminology and a considerable amount of data obtained by test methods as adopted by the British Electrical and Allied Industries Research Association.—*Journal of the Institution of Electrical Engineers, London,* April, 1926.

Hydro-Electric Development and Steam Equipment

Conowingo Project.—C. W. KELLOGG.—The contract for the construction of this Susquehanna River project was signed in March, 1926. It is calculated that the development will have an annual average output of about 1,360,000,000 kw.-hr. The dam of which the power house will be an integral part will be 4,800 ft. in length with a highway across the top. The spillway crest will be 86 ft. above sea level and its discharge capacity with all gates open will be about 880,000 cu.ft. per second. The ultimate dimensions of the power house will be 175 ft. in the direction of stream flow and 900 ft. lengthwise of the dam. The first construction will be 620 ft. in this direction. The initial installation will include seven 50,000-hp. turbines driving appropriate generators. Energy will be produced at 13,800 volts and stepped up to 220,000 volts for transmission to Philadelphia, about 70 miles away. It is calculated that the total energy loss from the generator at Conowingo to the low-tension buses in Philadelphia, including transformer and line losses, will be about 7 per cent. It is intended to operate Conowingo in conjunction with the steam plants on the Philadelphia system so that the hydro plant will at times of ample water flow act as a base-load plant, the steam plant taking the peak fluctuations. When the water flow is reduced the steam plants will assume the base load and the hydro plant take care of the peak. Because of the fact that the Susquehanna River is a state boundary between Pennsylvania and Maryland, special disposition had to be made for the construction and operation of the project. Arrangements were made to have the entire physical property owned, according to which state it was in, by two corporations, respectively of Maryland and Pennsylvania, and to have both lease in turn to the Philadelphia Electric Company either directly in Pennsylvania or through a Maryland subsidiary in Maryland whose undertaking the Philadelphia Electric Company guarantees. Contract for the design and construction of the dam and power house was awarded to Stone & Webster, Inc., who have associated the Arundel Corporation of Maryland with them in the construction work. The transmission-line contract was awarded to Day & Zimmermann, Inc. It is estimated that during construction about 3,500 men will be engaged at the site.—*Stone & Webster Journal,* April, 1926.

Transmission, Substations and Distribution

Vector Diagrams of Rectifiers. — G. W. MÜLLER.—The characteristics and the operating performance of alternating-current machines are frequently represented vectorially in circle diagrams. Some of the best-known representations are the Heyland circle diagram for three-phase motors and the short-circuit diagram for transformers. These diagrams cannot be readily used for the mercury-arc rectifier, but transformers and choke coils are usually in the circuit of rectifiers, and in conjunction with these diagrams can be developed which resemble closely the above-mentioned vectorial representation. They are very useful for the practical and quick design of rectifiers—in fact, have been used for some years past for the exact dimensioning of glass-bulb rectifiers for motion-picture arc lights. The author gives several examples of these little-known diagrams, all determined from built rectifiers, showing how closely the vectorial method checks with actual instrument readings.—*Elektrotechnische Zeitschrift,* March 18, 1926.

Bus Protection.—PHILIP M. CURRIER.—If it were possible and practicable to construct buses in such a manner that they could not fail, such construction would be adopted; but since this cannot be completely realized the next best solution appears to lie in building the bus in sections and isolating the faulty sections. Various reasons for bus failure, such as breakdown of insulation, fusing of conductors, arcing, etc., are discussed. Relay systems designed to localize faults are outlined and the statement is made that the general tendency in generating stations is to get away from a double-bus form of construction and to use instead a sectionalized bus arrangement.—*General Electric Review,* April, 1926.

Units, Measurements and Instruments

Standardization. — PERCY GOOD.—In this article the author reviews the progress of standardization in Great Britain, detailing the steps by which it reached its present important position and its co-ordination with developments in the same line in other countries through the work of the International Electrotechnical Commission. The standardization schedule follows an arrangement comprising nomenclature and symbols, simplifications of types and sizes, standardization of tests, interchangeability of parts, rules for performance, quality of material, and conditions of contracts and sales and guarantees of performance. — *Journal of the Institution of Electrical Engineers, London,* April, 1926.

High-Frequency Fatigue Tests. — In 1911 the late Prof. Bertram Hopkinson studied the effect of rate of alternation of stress on the fatigue limits of metals by means of an electrically operated machine capable of applying alternating direct stress at speeds up to about 7,000 cycles per minute. This speed was three times that of any previously used, but Professor Jenkins decided to reinvestigate the subject because both he and Professor Hopkinson believed that speed had a marked influence on the fatigue limit. Some of the results obtained have been published in a paper in the *Proceedings* of the Royal Society. The present article is a summary from the paper and describes the equipment used, methods of testing and results. Three materials, copper (99.97 per cent pure), "Armco" iron and a mild steel, were tested in the form of wire about 0.104 in. in diameter. The results are shown in the accompanying table. — *Engineer (England),* April 16, 1926.

TESTS OF THREE METALS FOR HIGH-FREQUENCY FATIGUE

	Periods per Second	Periodic Time, Sec.	Fatigue Stress, Tons per Sq.In.	Millions of Periods Without Fracture
Copper.....	50.3	0.0200	4.88	.....
	504.7	0.0020	5.01	15.3
	972.4	0.0010	5.33	12.6
	1,987.5	0.0005	5.53	10.8
"Armco" iron*	50.0	0.020	15.75	10.20
	501.7	0.002	16.65	12.30
	*980.0	0.001	16.80	12.50
	1,003.5	0.001	16.98	15.62
Mild steel....	49.5	0.020	16.30	.....
	498.0	0.002	16.85	12.5
	978.0	0.001	17.35	12.2

* "Armco" iron specimen subjected to cold-air blast during test.

Illumination

Sawtooth Design: Its Effect on Natural Illumination.—W. C. RANDALL.—The general object of sawtooth-roof construction in industrial buildings has been to avoid the admission of direct sunlight while giving maximum illumination on the working plane. The first part of the paper deals analytically with the question of the maximum permissible slope, taking into account the varying position of the sun at different times of the year and hours of the day, as related to the latitude of the place and the orientation of the building. Other conditions were studied with the aid of models, such as the span of the sawtooth, slope of windows, height of windows, painting of interior and height of sill. Some of the conclusions follow: (1) For practically all of the United States the windows should be placed on the vertical, if sunlight is to be excluded during the average working day. (2) In the lower latitudes of the United States, additional provision should probably be made to exclude sunlight. (3) Increase in the span decreases the minimum foot-

candles almost in proportion as the span increases, but has little effect on the maximum foot-candles; it necessarily increases the ratio of maximum to minimum. (4) With clean glass sloping increases both maximum and minimum, but after correction for dirt accumulation the advantage disappears. (5) Increase in height increases the maximum foot-candles proportionately and increases the minimum somewhat more than proportionately. (6) Painting the under side of the roof has relatively little influence. (7) Clear sheet or rough wire glass is preferable to ribbed. (8) Increasing the height of the sill improves the uniformity. (9) Glare-reducing coatings, shades, etc., not only cut down high intensities, reduce the heat and improve the uniformity of illumination, but also make it possible to face windows other than to the north. (10) Cleaning is important; the average efficiency of glass is, on account of dirt, not much over 35 to 50 per cent and has been found as low as 1 per cent.—*Transactions of I.E.S.*, March, 1926.

Motors and Control

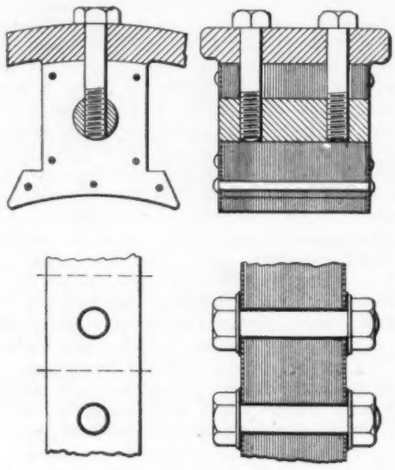
Power Supply of Cane-Sugar Mills.—W. PAPE and A. GRAF.—The great waste inherent in the installation of many relatively small reciprocating steam engines established quickly the advantages of a central steam-turbine power house and electric power distribution. So equipped, a modern mill may reach as low a power consumption as 0.6 kw. to 0.9 kw. per ton of cane pressed.—*Elektrotechnische Zeitschrift*, March 11, 1926.

Heat Applications and Material Handling

Gears Heat-Treated Electrically.—Two new types of automatic electric furnaces are described, one for normalizing automobile gears, the other for hardening them after carbonizing. The furnace for the former process is 26 ft. long and has a heating chamber 5 ft. 3 in. wide and 1 ft. high. It is divided into three zones—a preheating, a heating and a cooling zone. It takes three and one-fourth hours for the work to make its cycle through the furnace. The temperature of the heating zone is 1,650 deg. F. The rated capacity is 170 kw., supplied at 440 volts, 60 cycles, three-phase. It contains four conveyor tracks, two lines of work moving in opposite directions. Thus a transfer of heat occurs between the cool entering material and the heated material coming out, so that, it is asserted, 40 per cent of the heat is recovered. The temperature is automatically controlled. There are two such furnaces side by side, each giving an output of 2,550 lb. per hour, or 15 lb. of work per kilowatt-hour. Only two attendants are required for the pair. The hardening furnaces have each a capacity of 600 lb. per hour at 60 kw., i.e., 10 lb. per kilowatt-hour, giving an output per man of 54 gears per hour, as against an output of 45 with the box-type furnace formerly used.—*Iron Age*, Feb. 11, 1926.

Electrophysics, Electrochemistry and Batteries

Effect Produced on Permeance of Laminated Pole Core by Insertion of Solid Steel Fixing Piece.—D. HAGUE.—The object of this paper is to discuss the effect produced on the permeance of a laminated pole core which has been perforated with an axial circular hole into which a solid steel fixing piece or plug is inserted to receive the bolt which attaches the core to the yoke. The theory of a core in which the plug fits perfectly in the hole is first examined and curves for the permeance calculations are prepared. The theory is then extended to apply to a plug which fits loosely in the hole, the influence of imperfect fit being shown by a numerical example. The application of the theory in practical cases is shown in general to be satisfactory. In the extreme example of pole cores used in waterwheel generators where numerous secondary matters have to be considered the discrepancy between theory and practice is explained. The utility of the theory in calculating the permeance of transformer limbs consisting of laminations clamped together by insulated bolts is shown and uses in certain problems of current conduction—as, for instance, a perforated busbar—are suggested.—*Journal of Institution of Electrical Engineers, London*, April, 1926.



STEEL FIXING PIECE INSERTED IN LAMINATED POLE

Traction

Diesel-Electric Railway Car.—F. SCHULTESS.—To increase the rentability of secondary railway lines where operation of steam locomotives would not be economical the Federal Swiss Railways have now in operation a new type of Diesel-electric car, a description of which is given in this article. The car accommodates 50 seated passengers and has at one end a capacious baggage or freight compartment. Between the two is the engine room. The prime mover is a 250-hp., eight-cylinder, double-V-block, water-cooled Diesel engine of 550 r.p.m., operating in four cycles and without the aid of a compressor. Directly connected to its shaft is a six-pole direct-current generator for 325 amp. and up to 750 volts. Belted to a large pulley on the main shaft is a 26-kw. exciter, which also has to supply the energy for the brake compressor motor, the cooling fan motor and the charging of the starter battery. The latter comprises 90 nickel-iron cells for 160 amp.-hr. An auxiliary winding of the main generator is utilized for starting the power unit. Two 70-kw. (hour rating) traction motors drive the two four-wheel trucks of the car. A highest speed of 38 miles per hour may be reached, while the mechanical equipment of the car will stand up to 48 m.p.h. when towed as a car in a train. The complete wiring diagram of the car is given in the paper. The car, ready for service but empty, weighs 57 tons.—*Brown, Boveri Mitteilungen*, April, 1926.

Telegraphy, Telephony, Radio and Signals

Development and Application of Loading for Telephone Circuits.—THOMAS SHAW and WILLIAM FONDILLER.—For a brief summary of this paper reference may be made to the report of the A.I.E.E. midwinter convention in the ELECTRICAL WORLD, Feb. 20, page 397. The present publication reviews the theory of loading and gives the constants of various forms of loading coils that have been successively introduced in American practice, including powdered-iron-core coils showing a low effective resistance increase with frequency and remarkable freedom from residual magnetization effects, therefore great constancy of inductance. The permeability of the material used is about 35. Numerous charts accompany the paper, showing characteristics of loaded and non-loaded cables and of the coils themselves. The final part gives statistics of commercial application. The total number of loading coils in service in the Bell system, as of Jan. 1, 1926, is estimated at 1,250,000, providing loading for 1,600,000 miles of cable circuits and 250,000 miles of open wire. To give an equivalent grade of transmission without loading would have entailed an investment of more than $100,000,000 for interoffice trunks and toll open-wire circuits alone.—*Journal of A.I.E.E.*, March, 1926.

Public Address System.—W. O. SCHUHMANN.—The author describes the arrangements which were made at a dinner attended by 1,600 guests, to insure equal audibility of the speakers and the musical program. A condenser-type transmitter with an aluminum foil as membrane gave excellent service. This foil had a natural frequency of 7,000 and responded perfectly to frequencies between 50 and 5,000. The Siemens company developed for this occasion a special loud speaker on the electrodynamic principle. On a thin plate of insulating material ("Pertinax") was fastened a ribbon of copper arranged in a meandering shape. The edges of the ribbon could move in the narrow gaps of a large number of electromagnets. Passing 50 watts to 100 watts through the ribbon and maintaining a magnetic field of 8,000 gauss, very good reproduction was obtained with this device.—*Elektrotechnische Zeitschrift*, March 11, 1926.

News of the Industry

Seven-Dam Interstate Project for Nolichucky River

The Federal Power Company of Knoxville, Tenn., has applied to the Federal Power Commission for a preliminary permit covering a proposed development on the Nolichucky-Toe Rivers near the North Carolina and Tennessee lines. The primary power to be made available is estimated at 27,800 hp. The applicant proposes, however, to install 72,000 hp. The power is intended for public utility service and for use by the electrochemical industry.

The project consists of seven developments as follows: A diversion dam near Poplar, N. C., connected by a conduit and tunnel 12,000 ft. long to a power house with 15,000 hp. installed capacity; a diversion dam near Cane Bottom, N. C., backing water to the foregoing dam with a conduit and tunnel 11,000 ft. long to a power house with 15,000 hp. installed; a concrete dam 87 ft. high creating a reservoir 12 miles long in the Nolichucky River, the power house to be an integral part of the dam with 18,000 hp. installed; a concrete dam 125 ft. high across the North Toe River in the vicinity of Spruce Pine, N. C., which creates 50,000 acre-ft. of storage; a concrete dam 150 ft. high across Cane River near Elk Shoal Creek, N. C., which will create a reservoir for 45,000 acre-ft. of storage; a concrete dam 75 ft. high on the Nolichucky River at a point below Buckingham Ford to create a reservoir of 20,000 acre-ft. drawdown, with the power house an integral part of the dam, in which 14,000 hp. will be installed; a concrete dam 50 ft. high on the Nolichucky River, near Limestone, Tenn., where 10,000 hp. will be installed in a power house to be made a part of the dam.

Chesney Formally Elected President of A.I.E.E.

Cummings C. Chesney, manager and chief engineer of the General Electric Company's works at Pittsfield, Mass., was, in accordance with the membership ballot by mail ratifying the directors' nominees, elected president of the American Institute of Electrical Engineers at the annual business meeting held in the Engineering Societies Building, New York, on Friday, May 21. Other officers elected were: Vice-presidents, H. M. Hobart, Schenectady, N. Y.; George L. Knight, Brooklyn, N. Y.; B. G. Jamieson, Chicago; A. E. Bettis, Kansas City, Mo.; H. H. Schoolfield, Portland, Ore. Managers, F. J. Chesterman, Pittsburgh; H. C. Don Carlos, Toronto; I. E. Moultrop, Boston. Treasurer, George A. Hamilton, Elizabeth, N. J. (re-elected).

These officers, together with the following hold-over officers, will constitute the board of directors for the next administrative year, beginning Aug. 1: M. I. Pupin, New York; Farley Osgood, New York; P. M. Downing, San Francisco; Herbert S. Sands, Denver; W. E. Mitchell, Birmingham; Arthur G. Pierce, Cleveland; W. P. Dobson, Toronto; W. M. McConahey, Sharon, Pa.; W. K. Vanderpoel, New York; H. P. Charlesworth, New York; John B. Whitehead, Baltimore; J. M. Bryant, Austin, Tex.; E. B. Merriam, Schenectady, N. Y.; M. M. Fowler, Chicago; H. A. Kidder, New York; E. C. Stone, Pittsburgh.

The annual report of the board of

CUMMINGS C. CHESNEY

directors, presented at the meeting, showed a net increase in the membership during the year of 839, the total membership on April 30 being 18,158. In addition to the three general conventions of the Institute and two regional meetings, there were 1,114 meetings held by the local organizations in the principal cities and educational institutions in the country.

Pacific Gas & Electric's Mokelumne Project

Out of the development of water-power projects in the high mountain country of the upper reaches of the Mokelumne River, in Amador and Calaveras Counties, Cal., are to come increased water storage and the addition of another big hydro-electric power plant to the Pacific Gas & Electric system. The new development, a company publication explains, is to supplement the output of the Electra plant. A site for the reservoir has been selected at Salt Springs, in the Sierra Nevada Mountains, a point 3,800 ft. above sea level and 5 miles above the junction of Bear Creek and the Mokelumne. Here, where the river runs in a narrow gorge, whose granite walls rise a thousand feet above the stream, a rock-filled, concrete-faced dam 200 ft. high will be built, creating a reservoir of 60,000 acre-ft. capacity.

From this dam, which will be one of the largest rock-filled structures of its kind in the world, the water will be conveyed 23 miles by canal and tunnel to Tiger Creek, where it will be dropped 1,200 ft. to a new power house of 47,000 hp. capacity. This will be a modern high-head plant similar to Drum plant, on the Bear River in Placer County.

After passing through the generators of Tiger Creek power house the water will be carried on to the 27,000-hp. Electra plant, which has long been an important source of supply for the mines, towns and farms of the northern San Joaquin Valley, but has lacked sufficient water supply to operate at full capacity in the summer months. The added storage at Salt Springs will remedy this situation. The new development, including dam, canals, tunnels, lines and power plant, will cost about $10,000,000.

New York Edison's Coming Generating Station

The vanguard of the mammoth electrical units that will make the new East River station of the New York Edison Company larger than any steam-electric station now existing and add another link to the city's super-power chain ended its five-day journey by boat from Albany last week when the barge carrying 225 tons of electrical apparatus for the new power house docked at East Fourteenth Street. The barge had on board the two rotating parts of a huge 40,000-kva. frequency-changing set, each rotor being 13 ft. in diameter and 20 ft. long. This set consists of two generators placed end to end and connected on the same shaft, for the purpose of interchanging current from one system to another, and will be capable of converting 50,000 hp. from 25-cycle to 60-cycle frequency. So large was the armature for this frequency changer, which weighs 113 tons, that it was necessary to provide special right-of-way over the Delaware & Hudson Railroad to Albany from the Schenectady works of the General Electric Company, where it was manufactured. The maximum railroad clearance is 10 ft. so that it would have been impossible for a train to pass this apparatus on either side.

The new station, the first section of which will go into operation in the fall of this year, is to have an ultimate capacity of 750,000 kw. or more and is planned to serve New York's increased population in 1930. When operating at full capacity, it will equal the combined capacity of the Hell Gate station and Waterside No. 1 and Waterside No. 2, which with the Sherman Creek station now serve all Manhattan, the Bronx, Westchester County and part of Queens. It will have twice the capacity of the station at Genne-

villers, just outside of Paris, the largest in Europe. Possibly the palm for the "world's biggest generating station" will be ultimately contested between the East River plant and the projected State Line station of the Commonwealth Edison Company of Chicago, already described in these columns.

Texas' Electrical Progress Is Described by E. H. Kifer

E. H. Kifer, vice-president and general manager of the San Antonio Public Service Company, recently described in a club address the progress that is being made in the construction of high-tension lines in Texas, announcing that the plant which is being built at New Braunfels for the Comal Power Company will be ready for operation on Aug. 18. This plant, which is to burn pulverized Texas lignite blown into the boilers, will have the largest steam-turbine unit in the Southwest, Mr. Kifer said. It will have a capacity of 30,000 kw. The plant's ultimate rating will be 120,000 kw.

Transmission lines have already been completed from San Antonio through New Braunfels to San Marcos, where they connect with the Texas Power Company's lines. The San Antonio plant is now supplying current over this line to Taylor and Austin and recently furnished some to Waco. When the Comal plant is complete, all current will come from it, instead of from San Antonio. Lines have been built on the west to Hondo and D'Hanis, serving these places, Somerset, Lytle and La Coste; an interconnection will be made with the Texas Central Power Company near Devine to supply towns along the International-Great Northern Railway, including Cotulla and perhaps Laredo; a line will serve the Pleasanton section, and one will extend on the east to McQueenie, near Seguin, and probably later be extended toward Gonzales.

The West Texas Utility Company, Mr. Kifer said, is to extend a line down from Fredericksburg to Boerne, where it will connect with one from San Antonio, and it is the company's ultimate plan to carry the connection through to Abilene.

Industry Statistics Attract Power Club

Hot Springs Convention Attaches Great Importance to the Movement for Their Collection in Adequate Manner—Merger with A. M. E. S. Approved

INDUSTRY statistics, the proposed merger of the Electric Power Club and the Associated Manufacturers of Electrical Supplies and the report of the committee on business policies were the three outstanding items discussed by the Electric Power Club at its annual meeting, held at Hot Springs, Va., from Monday to Thursday this week. As President Waller stated in his address, which appears elsewhere in this issue, the main object of the club at this meeting was to obtain a greater efficiency in the direction of its business affairs and to turn the energy which has accomplished so much constructive work along technical lines into the large and fruitful field of commercial policies.

The subject of industry statistics not only received much attention but created a great deal of real interest among the members, and work has actually started in the gathering of data along some lines, while other proposed work will be undertaken. In a discussion of this subject Clarence L. Collens, 2d, gave utterance to the keynote when he emphatically declared that with statistics "we can guide our business more intelligently." The movement is undoubtedly gaining headway and bids fair to prove fruitful.

The report of N. A. Wolcott, chairman of the business policies committee, if it accomplished no other object, unquestionably pointed out the great need for uniformity in business practices, which resolves itself almost entirely into showing the necessity for more statistical data. Information collected by the committee regarding trade policies as to cash discounts, consigned stocks and similar matters showed that much can be done to stabilize business practices in a way that will not only redound to the credit of the members but help the industry at large. An analysis of the constructive report submitted by Mr. Wolcott will appear next week.

The proposed merger of the Electric Power Club and the Associated Manufacturers of Electrical Supplies to form the National Electrical Manufacturers' Association was considered by the Power Club, and it unanimously adopted an amendment to its by-laws and constitution to permit the merger to take place. At a meeting of the A. M. E. S. which will take place early in June a similar amendment will be proposed for adoption. This, if adopted, will permit the new organization to become effective on Sept. 1.

New officers elected by the Electric Power Club are: President, J. M. Curtin, Westinghouse Electric & Manufacturing Company; vice-president, M. O. Troy, General Electric Company.

Reading Ratifies Edison Contract

By a vote of 1,037 to 527, a referendum on Wednesday at Reading, Mass., finally ratified a contract between the municipality and the Edison Electric Illuminating Company of Boston for the supply of electricity in bulk. The Edison company will build two 5,000-kva., 13,800-volt underground lines, 15 miles long, between Stoneham and Reading and the initial energy supply will total about 4,500,000 kw.-hr. a year. By 1935 it is estimated that the service will require the purchase of 10,000,000 kw.-hr. a year. The contract was recently awarded to the Boston company after a long contest in which the purchase of electricity elsewhere and the expansion of the Reading town plant figured as solutions of the problem.

Symposium on Dielectrics

Measurements and Tests in This Field Topic of First Day of Institute Niagara Falls Meeting

WITH an initial registration of about 350, the regional meeting of the American Institute of Electrical Engineers opened on Wednesday, June 26, at Niagara Falls, N. Y. The first day's program was devoted to a symposium on methods and results in measuring the power factor of dielectrics.

Dr. J. B. Whitehead, Johns Hopkins University, opened the morning session, of which Prof. A. E. Knowlton was chairman, with a brief description of the origin and causes of phase difference in insulating materials. Harvey L. Curtis of the Bureau of Standards pointed out the need for a convenient standard to be used in connection with testing the power factor on insulation on high-voltage cables, classified types of condensers now used in laboratories for testing and warned against various sources of error. R. E. Marbury of the Westinghouse Electric & Manufacturing Company read a brief paper on commercial dielectric loss measurements.

That the power-factor accuracy should be within 0.002 in measurement of insulation on very high-voltage cables was the contention of C. F. Hanson, Habirshaw Electric Cable Company, who also discussed the effect of the error in knowledge of the thermal properties of the cable and duct on the accuracy of dielectric power-loss measurements. E. S. Lee, General Electric Company, described the different methods of using dynamometer voltmeters and stated that comparative measurements indicated an error from tone measurements of between 10 and 20 per cent with this method. E. D. Doyle and E. H. Salter, Electrical Testing Laboratories, outlined three methods now used in these laboratories, and B. W. St. Clair, General Electric Company, mentioned some of the difficulties of designing and calibrating an accurate test set from the instrument engineer's point of view.

The morning session closed with a discussion in which P. L. Hoover of Harvard University brought out the necessity of proper capacity balances for accurate testing by bridge methods and E. W. Davis, Simplex Wire & Cable Company, stated that reflection wattmeters had been found to check well with more accurate laboratory methods in factory testing of reel-length cables. N. L. Morgan, Northern Electric Company, Montreal, briefly described the way in which a water-tube set had been devised in that city, and Robert Notvest, Brian O'Brien, T. M. Stein, J. D. Stacy and Delafield du Bois emphasized various points brought out.

W. A. Del Mar was chairman of the afternoon session, at which papers by W. B. Kouwenhoven and Paul L. Betz of Johns Hopkins University on the zero method of measuring power with the quadrant electrometer and by D. M. Simons and W. S. Brown, Standard Underground Cable Company, on compensation for errors of the quadrant electrometer were presented. After the session closed convention delegates and guests enjoyed a trip by water to Toronto with a return by moonlight.

Power Projects in Canada

Work Beginning at Arvida, Chute-a-Caron and Outarde Falls—Taschereau's Policy

PLANS for immediate construction work on a vast scale on the huge power development plant and aluminum factories in the Lake St. John district of northern Quebec, situated at Arvida and Chute-à-Caron, are under way, according to officials. The Quebec Development Company, builders of the power plant involved in the recent transfer of interests from the Duke-Price to the Aluminum Company of America, has just prepared for shipment to Chute-à-Caron $2,000,000 worth of equipment for construction of the dams, canal and power plant.

Work on the development of 40,000 hp. on the Outarde River, on the north shore of the St. Lawrence in the Province of Quebec, has been started by the Ontario Paper Company. In January, 1923, this company leased from the provincial government 2,000 square miles of timber limits along the Manicouagan River, about 100 miles east of the Saguenay. At the same time the Outarde Falls, on the river of the same name, were leased to the company, with a clause providing that within three years development work must start.

The Shawinigan Water & Power Company has obtained authority to build its projected 165-kv., 150-mile transmission line between Quebec city and Ile Maligne in the Saguenay district, which is expected to cost $4,000,000 or more. As previously reported, the power to be used in the Quebec district (100,000 hp.) will be purchased by Shawinigan from the Aluminum Company of America.

Preparations are already under way by the Ontario Hydro-Electric Power Commission to commence work on the high-tension transmission line which will carry power from the International Paper Company's development on the Gatineau River, near Ottawa, to Toronto. The preliminary reconnaissance will be by airplane and will be the first big work of the kind in Canada to be done by aërial survey, although airplanes have been employed by the Ontario Hydro from time to time on the Niagara system. The line will terminate at Chats Falls on the Ottawa, where the commission expects later on to undertake its own development.

TASCHEREAU LAUDS QUEBEC POLICY

Premier Taschereau of Quebec declared in a public address last week that the province's policy of prohibiting the export of electrical energy would create for it great industrial centers by keeping 15,000,000 hp. for its own people. The Lake St. John district, for instance, would soon house the biggest aluminum plant in the world, which would employ more people than the Ford corporation and call for an investment of $100,000,000. Shawinigan, Grand'Mère and La Tuque were cited as further examples of the government's policy of developing water powers. The Three Rivers district, he said, now supplies one-sixth of all the pulp and paper on the American continent. The International Paper Company had recently asked whether the government would build a dam on the Gatineau River and rent it to the company. The government had refused, saying that if the company wanted a dam it might build one itself, at a cost of $3,500,000, and pay the province $35,000 a year for the use of the water. The company agreed.

PASSAMAQUODDY TIDAL PROJECT

No decision has been reached on a bill introduced in the Canadian Parliament to incorporate the Canadian Dexter P. Cooper Company to develop tidal power in Passamaquoddy Bay and sell the same for use in any manner at any place in Canada and in the United States. The committee to which it was referred decided to postpone consideration until officers of the Canadian government can submit their opinion as to navigation, marine and fisheries rights in general and water-power rights in particular at this international site. The question of jurisdiction of the International Joint Commission also came up, and it was decided to insert a clause in the bill to establish it.

Hope for Boulder Dam Bill Vanishes

Measure Thought Securely Tabled for This Session—Friends of Muscle Shoals Legislation, However, Still Optimistic—No Flaw in Wilson Dam Control

BY PAUL WOOTON
Washington Correspondent ELECTRICAL WORLD

ALL probability of advancing further the Boulder Dam legislation at this session of Congress vanished when the House committee on irrigation and reclamation on May 21 voted to table the revised Swing-Johnson bill. The so-called power amendments prepared by Representative Leatherwood of Utah and summarized in the ELECTRICAL WORLD for May 15, page 1068, were withheld until the time should be more propitious for their formal presentation.

The irrigation committee devoted virtually all of its time at this session of Congress to the consideration of the Boulder Dam question. Finally it became clear that no agreement could be reached. This led Representative Hayden of Arizona to offer the motion to table. The vote on the motion was nine to six. Representative Leatherwood and Representative Allen of Illinois, Republicans, joined with the seven Democratic members of the committee in supporting the Hayden motion. Those voting against the motion were Chairman Smith of Idaho, Swing of California, Leavitt of Montana, Arentz of Nevada, Winter of Wyoming and Davenport of New York.

Senator Johnson of California is planning to make a speech on the subject, and an effort may be made to bring the bill to a vote in the Senate. It is not believed, however, that it can be passed, despite the fact that it is on the calendar with a favorable report. It is expected that some new plan will be brought forward at the next session. This may take the form of a proposal for the construction of a project by a public corporation which would construct and operate the dam and power house but would sell the output to the highest bidder. Some are of the opinion that Arizona may modify its position after the gubernatorial elections this fall.

No Restriction on Federal Control of Wilson Dam Site

In reply to an inquiry concerning any concessions which may have been given by the State of Alabama in connection with the construction of the Wilson Dam, Major-General Harry Taylor, Chief of Engineers, has written:

"No grants or cessions of property have been obtained from the State of Alabama in connection with the construction of Dam No. 2, Tennessee River. The lands and flowage easements required were obtained from private owners by purchase, donation or condemnation. The ownership of the bed of the river on which the dam is built is understood to be in the state, but such ownership is qualified by an easement in favor of the general government for the benefit of navigation. The federal government has a right to the full flow of the river and the right to occupy and use for the improvement of navigation the whole body of the stream and the soil thereunder between ordinary high-water lines, and this right is paramount and exclusive of any state or private rights in such areas. Dam No. 2 is a part of the projected inprovement of the Muscle Shoals section of the Tennessee River and has been located and constructed in pursuance of plans presented in House Document No. 1262, Sixty-fourth Congress, first session, which provides both for the improvement of navigation and the development of power."

Web of Politics Spun Around Pending Muscle Shoals Bill

Members of the joint congressional committee on Muscle Shoals continue to believe that the bill they have recommended will be passed at this session of Congress. While no opportunity will be lost to attach the measure as a rider to any promising bill, Senator Deneen, the chairman of the committee, will insist that the measure is entitled to a place of its own on the legislative program. When the appointment of the joint committee was before Congress neither house would brook the slightest interference or delay. The resolution creating the joint committee was put through by what some characterized at the time as steam-roller methods. Since two or three of the leaders are not pleased with the recommendation made by the committee, all of the need for action at the earliest moment of which they talked when the resolution was pending seems to have been forgotten. Congress, however, made too much of an issue over prompt action on Muscle Shoals to refuse with any consistency to consider the report of the committee.

A number of legislators who favor the acceptance of the committee's bill are not particularly anxious to vote on it at this session of Congress. There are elections in the autumn, the question of disposition of Muscle Shoals is a highly controverted one, and a vote either way would mean some loss of support. The bill may not, however, have as much opposition from the so-called public ownership group as was at first supposed. Senator Norris is understood to have said that it is not the worst bill that has come before Congress. Since he recognizes that government operation cannot be obtained, he is believed to see in this bill a personal victory in preventing the power property from falling in the hands of Henry Ford or any unregulated company. The Vare victory in Pennsylvania is likely to have a direct bearing on the Muscle Shoals bill in that it has greatly increased the influence in the House of Representative Morin of Pittsburgh, the chairman of the military affairs committee and the ranking House member of the joint congressional committee. There is little probability, however, of action on the House side unless the bill passes the Senate. In the Senate the steering committee still is marking time awaiting a clearing up of the agricultural relief situation.

Power Board Informs Itself on Mokelumne and Okefenokee

Favorable action by the Federal Power Commission on the application of the East Bay cities for rights on the Mokelumne River in California is foreshadowed by the receipt of a favorable report on the project from the engineers who made the field examination. (See ELECTRICAL WORLD for May 22, page 1164.) The principal purpose of the project is to provide storage for the municipal water supply, but a 12,000-hp. hydro-electric plant is planned.

Objections to the project have been filed by the California Reclamation Board and land owners in the delta of the Sacramento River. The Reclamation Board is insisting that the Lancha Plana reservoir should be adapted to flood control. No engineering data to support this contention, however, have been received. The farmers on the lower Sacramento fear further encroachment of salt water on their lands if the flow of fresh water is reduced. The amount diverted, however, is regarded by the engineers as insufficient to have any bearing on the salt-water situation.

Before passing upon the application of Hill & Spencer of Jacksonville, Fla., for power rights on the Suwanee and St. Mary's Rivers, the Federal Power Commission expects to have a special study made of the value to the project of the proposed storage in the Okefenokee Swamp. The State of Georgia has objected to the granting of the permit, but despite two postponements of the hearing, has not submitted any reasons for such action. Protests also have been filed by lumber interests and by a hunting and fishing club which declares that its properties will be impaired by retarding the run-off. The primary power involved is 38,000 hp.

Purchases and Mergers

Ten States and Three Canadian Provinces Are Represented in This Week's Announcements

PROPERTIES of the United Power Company and the Chandler Electric Company serving fourteen communities in Oklahoma have been purchased by the H. M. Byllesby interests from Robert K. Johnson of Oklahoma City and will be operated as part of the Oklahoma Gas & Electric Company system. The Chandler Electric Company has a distribution system serving Chandler, Wellston, Stroud, Warwick, Davenport and Meeker. The properties, already connected to the transmission lines of the central division of the Oklahoma Gas & Electric Company, supply an important oil-field district in Lincoln County. The United Power Company serves Medford, Jefferson, Hillsdale, Cremlin, Lahoma, Meno, Goltry, Helena, Nash and Jett, an agricultural section in Alfalfa, Grant and Garfield Counties. These properties will be connected by a new high-tension line to the Enid division of the Oklahoma Gas & Electric Company.

The Derby (Conn.) Gas & Electric Company will be taken over in the near future by the Citizens' Utilities, Inc., New York, if 80 per cent of the company's stockholders ratify an offer of $7,600,000, or $76 per share, for this property. The Citizens' company is a subsidiary of the Utilities Power & Light Company, Chicago.

The Cleveland Electric Illuminating Company has purchased the electric light and power system serving certain towns in Ashtabula County, Ohio, adjoining its previously announced acquisitions in this district.

The Central Illinois Public Service Company has applied to the Illinois Commerce Commission for authority to purchase the New Holland Light & Power Company for $11,000.

The Interstate Public Service Company has received authority to buy the French Lick & West Baden Water, Light, Heat & Power Company, an Orange County (Ind.) corporation, for $500,000.

The Princeton (Ind.) Water & Light Company has been sold to George H. Knutson, Chicago, and his business associates.

The Eastern New York Utilities Corporation of Rensselaer has petitioned the New York Public Service Commission for consent to purchase the stock of the Blue Hill Light & Power Corporation of the town of Livingston, Columbia County. The Rensselaer company is distributing electricity in the town of Greenport, which adjoins Livingston. The Blue Hill company, recently organized, has no power facilities of its own.

The Harvard (Neb.) Electric Company, owned by Person Brothers of Holdrege, has been purchased by the Southern Nebraska Power Company of Superior and possession taken. The Southern serves a number of towns in the vicinity of Harvard.

The Nebraska State Railway Commission has approved the application of the Continental Gas & Electric Corporation for authority to merge the Blue River Power Company, recently purchased, with the Nebraska Gas & Electric Company, and to dissolve the former. The Blue River company has generating stations capable of producing 5,500,000 kw.-hr. a year.

Purchase of the electric light plants at Brackettville and Moulton, Tex., is announced by E. B. Neiswanger, general manager Texas Central Power Company of San Antonio. The Brackettville electric and ice plants will be managed from the district office at Del Rio.

The Public Service Company of Colorado has purchased the Rifle Light, Heat & Power Company of Rifle, Col., for a price estimated to be in the neighborhood of $60,000.

The Waldron Electric & Power Company of Waldron, Ark., has been taken over by the Central and South West Utilities Company, and will be operated by the Southwestern Gas & Electric Company. Waldron has a population of 1,800, and is the county seat of Scott County. It is located 140 miles north of Texarkana, Ark., in the Ozark Mountains.

The International Utilities Corporation announces the acquisition of the electric light and power plant formerly owned and operated by the town of Vegreville, in the center of a rich farming district about 70 miles east of Edmonton, Alberta, Canada. Although this plant is small, its acquisition is of significance since it is said to be the first instance in the Canadian West where a municipally owned property has been sold to a large privately owned public utility interest.

The reported purchase of the Hull (Quebec) Electric Company from the Canadian Pacific Railroad by the Canadian International Paper Company has been confirmed by A. R. Graustein, president of the paper company. The transaction, he says, involves complete ownership of the Hull company, and not merely stock control.

The Avon River Power Company of Nova Scotia, which supplies a large section of the eastern and middle portion of the Annapolis Valley in that province, early this year acquired the properties of the Windsor Electric Light Company, and on July 1 it will extend its territory by the absorption of the Gaspereaux River Light, Heat & Power Company. This company now controls the power situation in the Province of Nova Scotia between the Gaspereaux River and Halifax.

Electrical Credit Men Meet at New York

Two hundred members of the National Electric Credit Association met in New York City on Thursday and Friday, May 20 and 21, for the annual convention of that association. The reports and addresses were, as usual, varied by entertainment features. The association re-elected all its executive officers as follows: President, H. E. Wilkins, Belden Manufacturing Company, Chicago; vice-president, F. P. Bell, Westinghouse Electric & Manufacturing Company, Philadelphia; secretary-treasurer, Frederic P. Vose, Chicago.

Farm Bureau Attack Answered

Advocates of Pending Bill for Disposition of Muscle Shoals Are Quoted in Refutation of the Objections Put Forth in the Name of Agriculture

THE adverse report of the American Farm Bureau Federation on the bill now before Congress accepting the bid of the associated Southern power companies for the lease of the government Muscle Shoals properties has brought forth from the advocates of the bill vigorous rejoinders. The views of the Farm Bureau were summarized last week (page 1159). It objects to two leases. The advocates of the measure hold that this is the businesslike way to build the corporate structure, since it can be shown that the general practice on the part of corporations is to handle a distinct activity through a subsidiary. For the power company to attempt to handle the fertilizer project would mean mingling of funds and numerous difficulties which would be to the detriment both of orderly business practice and of the fertilizer enterprise. The responsibility of the power company is in no sense diminished by the separate leases. If the English language means anything, it is declared, the power company would not be able to continue after the fertilizer company had failed to fulfill its obligations. The power company agrees never to dispose of any part of its holdings in the fertilizer company and is held strictly responsible by the lease for the operation of the plants.

A coffee mill may be operated without coffee, it is pointed out, but it would be impossible to operate air reduction apparatus and other equipment of a nitrogen plant without production, even were there any thought that such evasion of the intent of the contract would be possible. The Secretary of War is authorized to forfeit all rights of the power company if there should be a default on the part of the fertilizer company. In the opinion of competent lawyers, the exact legal effect of the agreement is that the power company is bound by the agreements made for itself and the agreements made by the fertilizer company. There is no doubt in the minds of the majority of the committee that if the fertilizer company fails the power company will fail also. The lease sets forth clearly that a definite amount of fertilizer must be produced. Operations must begin within the three-year period and must continue uninterruptedly unless 5,000 tons of fertilizer, suitable for agricultural purposes, should be on hand without demand. This means that a stock of $1,500,000 worth of fertilizer must be maintained.

Not a Mere Experiment

The contention of the Farm Bureau that the project is an experiment with a new process, which means no fertilizer if it should fail, is held to be an assumption without foundation. The process to be used at Muscle Shoals has been in constant use in this country for a number of years and is being used daily at the present time. Though it is true that it is not being used for fertilizer production, the only reason it is not being used for that purpose is because no one ever has put in the capital necessary. The provision for the possible adoption of another process, which the Farm Bureau regards as one of the sinister features of the agreement, was put in at the request of the committee over the protest of the power company. The power company has no doubt as to the success of the process it will use.

The claim that high payments to the government make the power costly for any purpose is a condition for which the joint committee is largely responsible. By good trading the committee pushed the price for the properties to a higher figure than previously had been thought obtainable. It is obvious, however, that the power company will not object to any reduction in the amounts to be paid the government, if Congress should see fit. Since power is to be furnished the fertilizer company at cost, the point does not apply as forcefully to that use as to public utility consumers, but the surplus power all will be disposed of under public regulation. Cheap power will not be put in the hands of unregulated industry. In view of the point just dealt with it is difficult to understand how the Farm Bureau consistently could demand an amortization feature in addition.

Apparently the Farm Bureau is in error in its contention that the nitrogen produced may be sold in forms other than fertilizer. This plainly is not permissible under the terms of the lease, unless it should be required by the farmer board. It can be stated authoritatively, however, that there has been no thought and no plan for producing nitrogen in other forms.

Farmer Board Not a Figurehead

Exception also is taken to the statement that the farmer board is a mere figurehead without power or responsibility. The lease provides that the board is to direct the kind of fertilizer which is to be made, whether it is to be mixed or unmixed, with or without filler. It determines when there has been any default, and if the process were to be changed, it would specify the new process. It has supervision of all accounts and determines the price at which the product is to be sold. If the board is not representative of agriculture, it would be the fault of the Secretary of Agriculture, as he is directed to appoint to the board three representatives of farmers' organizations, a representative of the Department of Agriculture and a nominee of the fertilizer company. Some of the paid representatives of farmers' organizations may be ineligible for appointment, owing to the provision that the representatives of the organizations must be actually engaged in farming.

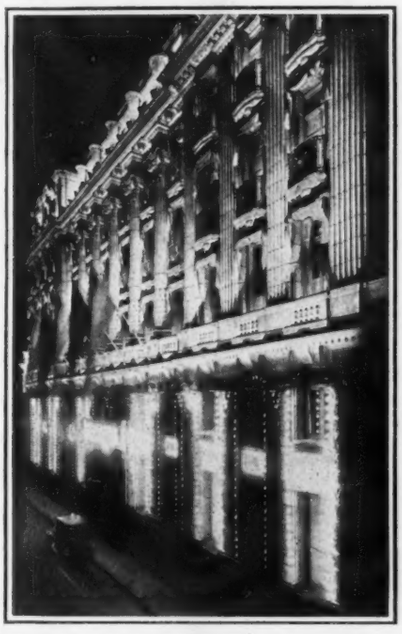
The power company is understood to be perfectly willing to accept the Farm Bureau's wording, "cost plus 8 per cent," with reference to the return, to supplant that of the proposed lease, which is "cost plus 8 per centum profit."

The Farm Bureau objects to the charging of the maintenance of plant No. 2 to fertilizer. Plant No. 2 must be held in standby in readiness for use in the national defense. The fertilizer company apparently was considered by the committee as the logical custodian.

It also is charged that the proposal is not a definite lease, but it does not require a lawyer to see that all of the definite statements contained in the lease are just as binding as law can make them.

In reply to the argument that the bidder has no experience in fertilizer production and has refused repeatedly to engage in it at Muscle Shoals, it is pointed out that the power company made a fertilizer offer two years ago. The charge of inexperience would lie against any possible operator of the plant except those now engaged in fertilizer manufacture. It has been apparent throughout that Congress has desired to keep fertilizer production at Muscle Shoals out of the hands of the present fertilizer industry. Representatives of the power company point out that their business requires the maintenance of a large engineering staff

Floodlighting Gains Foothold in Buenos Aires



THE Cia Hispaña Americana de Electricidad of Buenos Aires, the largest lighting company in the Argentine and one of the largest in South America, has decorated its administration building by the installation of floodlamps which bring out the beauty of its architecture and make it one of the ornamental spots in the night illumination of the city. The lower part of the building is of a very dark grade of granite, for the relief of which it was found desirable to use lines of exposed lamps. For the upper portion 70 General Electric type "L-11" units are used to bring out the details of architecture.

and that engineers are accustomed and trained to conduct all kinds of enterprises. Public utilities frequently are called upon to conduct dissimilar businesses. Their record in such enterprises has been one of success, and there is full confidence that they will be able to go into the fertilizer business from the ground up and make a success of it.

Dr. Pupin on Mental Attitude of Engineer

Present engineering and scientific developments are the result of a two-thousand-year struggle to overcome the inertia of man's mental attitude, declared Dr. Michael I. Pupin, president of the American Institute of Electrical Engineers, in an address before the Cleveland Section at the Hotel Statler, Cleveland, on Tuesday, May 18. Dr. Pupin emphasized the influence which the scientific mental attitude of the engineer has had upon civilization and defined it as that attitude which interprets nature in its visible forms. The history of the evolution of man, he said, is the history of the progress of the scientific mental attitude in its relation to political and industrial developments.

Terming the period following the Civil War "the American Renaissance," Dr. Pupin declared that the establishment of universities and research laboratories and the entrance of science into industry formed the most striking achievement of engineering in this country. It marked the passing of the control of industry from the hands of the so-called practical man to those of the still more practical but scientific engineer. In the light of present-day accomplishments in scientific and technical development the engineer has every reason to be proud of his calling, said the speaker, and with that background, his mental attitude and method of work he will accomplish even greater things in the future.

S. P. E. E. May Become "Engineering Education Society"

A motion to shorten the name of the Society for the Promotion of Engineering Education to "Engineering Education Society" has been submitted to the members for a ballot by mail and will be brought before the thirty-fourth annual meeting, to be held at the State University of Iowa, Iowa City, on June 16 to 18.

The convention will be opened with an address of welcome by President Walter A. Jessup of the university with response by President George B. Pegram of the society. Reports of collateral studies relating to the investigation of engineering education will follow, these including studies conducted by the founder societies, studies conducted by the National Industrial Conference Board and a paper on extension courses in engineering by Prof. C. M. Jansky of the University of Wisconsin. On Thursday, the second day, there will be reports of investigative committees of the society, reports on special studies relating to the investigation of engineering education and a "summary of fact-gathering stages of the investigation of engineering education" by H. P. Hammond, associate director of investigations.

At the annual dinner on Thursday evening, presided over by Vice-president H. V. Carpenter, Dean Pegram will give his presidential address on "Surveys of Higher Education." Friday morning Prof. Charles F. Scott, chairman, will preside and W. E. Wickenden, director of investigations, will discuss the report of the board of investigation and co-ordination, of which there will be a general discussion. The usual group conferences will be held during the convention.

Briefer News

Western Engineers to Meet Next Week.—The fifty-sixth annual meeting and dinner of the Western Society of Engineers will take place Wednesday, June 2, at the Palmer House, in Chicago.

Bridge River Plant in British Columbia to Be Started Next Year.—Definite announcement has been made at Vancouver, B. C., that a start will be made early next year on the huge Bridge River hydro-electric development of the British Columbia Electric Railway Company. The company will spend $12,000,000 in the development of the first unit of 60,000 hp. Ultimately it is planned to develop 210,000 hp. at an aggregate cost of $30,000,000.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, Jan. 2, page 80.]

Western Society of Engineers—Palmer House, Chicago, June 2. E. S. Nethercut, 53 West Jackson Blvd., Chicago.

Electrical Supply Jobbers' Association—The Homestead, Hot Springs, Va., June 2-4. F. Overbagh, 411 South Clinton St., Chicago.

Association of Iron and Steel Electrical Engineers—Hotel Sherman, Chicago, June 7-10. John F. Kelly, Empire Bldg., Pittsburgh, Pa.

Associated Manufacturers of Electrical Supplies — The Homestead, Hot Springs, Va., June 7-11. F. Nicholas, 30 East 42d St., New York.

North Central Division, N.E.L.A.—St. Paul Hotel, St. Paul, June 8-10. J. W. Lapham, 351 Loeb Arcade, Minneapolis.

Pacific Coast Division, N.E.L.A.—Biltmore Hotel, Los Angeles, June 8-11. S. H. Taylor, 447 Sutter St., San Francisco.

Northwest Division, N. E. L. A.—Spokane, Wash., June 14-17. L. A. Lewis, Washington Water Power Co., Spokane.

American Association of Engineers—Philadelphia, June 14-19. M. E. McIver, 63 East Adams St., Chicago.

Georgia Electrical Association—Columbus, Ga., June 15, 16. W. W. Barr, 25 Houston St., Atlanta.

Society for the Promotion of Engineering Education — Iowa City, Iowa, June 16-18. F. L. Bishop, University of Pittsburgh, Pittsburgh.

American Institute of Electrical Engineers — White Sulphur Springs, W. Va., June 21-25. F. L. Hutchinson, 33 West 39th St., New York.

American Society for Testing Materials — Chalfonte-Haddon Hall, Atlantic City, June 21-25. C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

National Council of Lighting Fixture Manufacturers—Montreal, June 23-26. H. B. Garrett, 424 Guarantee Title Bldg., Cleveland.

American Society of Agricultural Engineers—Lake Tahoe, Cal., June 23-26.

Michigan Electric Light Association—Mackinaw Island, June 24-26. Herbert Silvester, Edison Bldg., Ann Arbor, Mich.

Houston Company Lets Contract for New Unit at Deepwater.—Contract for the construction of a third unit in its power plant at Deepwater, Tex., has been awarded by the Houston Lighting & Power Company. It will cost $2,000,000, according to Hiram O. Clarke, assistant manager. The new unit will be rated at 25,000 kw. and will more than double the capacity of the plant.

Hydro-Electric Plant for British Malaya.—A hydro-electric plant with a capacity of 18,000 kw., the first considerable power development to be undertaken in British Malaya, is to be built on the Parak River, according to consular advices to the Department of Commerce from Singapore. A 5,000-kw. steam auxiliary plant will be provided, and the total cost of the project is estimated at more than $12,000,000. Four years will be required for its completion.

Contract Let for New Yadkin River Plant.—Award of contract for the new 100,000-hp. plant of the Carolina Power & Light Company of Raleigh, N. C., at Swift Island on the Yadkin River is announced. The total cost of the project, including the dam, power station and equipment, is estimated at $8,000,000. The plant will serve the central part of the state and put it on a parity with the Piedmont section in the matter of power available for industrial enterprises.

Damming the Shannon Proceeds, but Against Obstacles. — The Siemens-Schuckert company, which has the contract for the hydro-electric development that the Irish Free State government is undertaking on the Shannon River, announces that the labor difficulties brought about by a strike called on the ground that the German firm was paying less than the local scale of wages have been overcome, that the preliminary work has been done and that construction of the dam will begin.

Undeveloped Water Power in Rogue River Basin.—The potential power of Rogue River, Oregon, and its principal tributaries under the natural flow is 514,000 hp. for 50 per cent of the time and 202,000 hp. for 90 per cent of the time, and by the construction of four reservoirs these figures could be increased to 532,000 hp. and 429,000 hp., according to a statement just issued by the Geological Survey. There are eight water-power plants in this basin, but the combined capacity of the installed machinery is only 13,000 hp. The report includes a general description of the river valley, a study of the water supply and a brief description of the eight developed and of 28 undeveloped power sites and four undeveloped reservoir sites. If located in the industrial section of the Eastern or Southeastern States, all the sites selected in the Rogue River basin would be economically feasible of development, but southwestern Oregon is rich in water power

and the time of development of each site will depend on the market and on the cost of development as compared with that at other sites in the same locality.

Zambesi and Yguassu Outdone?—A dispatch from the city of Quebec states that what is considered to be the most important expedition ever sent out by the provincial government will soon leave to explore the interior of Ungava. The principal aim of the expedition is the preparation of a detailed report on McLean's Falls, which have been said to be 800 ft. in height and three-quarters of a mile wide, or much the largest in the world. Three airplanes are to be used for the work. Ungava is an unorganized district occupying the whole of the Labrador peninsula north of the Province of Quebec except the coastal strip which is under the administration of Newfoundland.

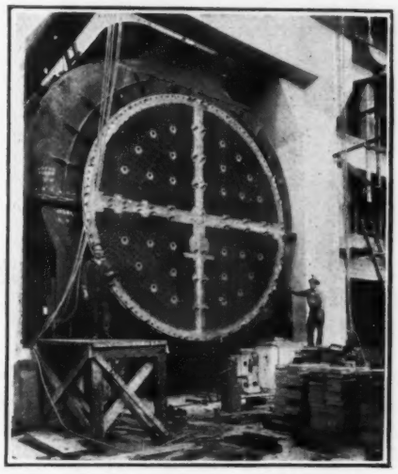
Work to Start Next Month on Oswego's New Generating Station.—The Oswego River Power Corporation will begin next month to build a new plant on the Varick Canal at Oswego. Three 3,000-hp. turbo-generators will be installed in a structure of modern design which will contain complete switchboard equipment for both incoming and outgoing lines. The station will be tied in with the system of the Northern New York Utilities, Inc., and will be rushed to completion, thus helping the power situation in the district, where, as reported the other week, there has been considerable popular dissatisfaction and an effort to have the city generate hydro-electric power on a canal site owned by it.

La Belle, Mo., Is in Unique Position Electrically. — A few years ago the Missouri Power & Light Company purchased the municipal electric plant in the small town of La Belle for $10,000, half of which was to be paid in cash and half in street lighting under a twenty-year contract. The city, not being legally able to use the $5,000 cash for general purposes, bought preferred stock in the company with it and now reinvests its dividends in more stock. Thus the citizens are in the position of having no street-lighting bills to pay and of owning collectively a growing block of the stock of the company serving them. General satisfaction with the arrangement is reported.

Applying Electricity to Dredging.—The first dipper dredge with complete electrical equipment in the United States, said to be the most powerful craft of its type yet manufactured, was launched recently at the Camden (N. J.) yards of the American Brown-Boveri Electric Corporation. Not a pound of coal will be used on the dredge, which will have two Diesel-engine units generating a total of 1,300 hp., applied through 25 motors. The dredge is for the Great Lakes Dredge & Dock Company and will be used on the Atlantic seaboard. It is capable of operating independently off shore for a period of six weeks, since it evaporates its own water supply. It also is capable of operating either in salt or fresh water to a depth of 50 ft.

Tennessee Power Company to Be Revalued. — With Commissioner Porter Dunlap dissenting, the Tennessee Railroad and Public Utilities Commission has ordered a complete appraisal of the properties of the Tennessee Electric Power Company. Commissioner Dunlap objected that a new valuation would cost $100,000, which would be passed on to the consumers, and said that the commission should take the rate base previously fixed and add to it any increases of property since made. The majority members of the commission, Harvey H. Hannah and Julian Campbell, held that it would be very difficult to place a value on the property using reproduction cost as of May 1, 1923, because of many additions and removals.

Giant Condenser for Long Beach (Cal.) Plant.—This condenser, now being installed in the new unit of the Long Beach steam plant of the Southern California Edison Company, was built by the Westinghouse company. It has 75,000 sq.ft. of surface. There are 14,300 1-in. tubes, 20 ft. 7 in. in



length—more than 50 miles of tubing. It will be capable of condensing 600,000 lb. of steam per hour at a vacuum of 29 in. of mercury. When operating it will use 100,000 gal. of water (salt) per minute for cooling purposes. Two Westinghouse pumps, each with a caacity of 50,000 gal. per minute, driven by 2,300-volt motors, supply this water.

Mexican Water-Power Project.—What is said to be the most notable sale of land in Mexico since the new alien land law went into effect was effected recently when the hacienda of San Ignacio del Buey, embracing 1,256,000 acres in the State of San Luis Potosi, was sold by O. D. Jones to Juan J. Lopez of Tampico and associates. Mr. Lopez has organized the Sociedad Co-operative Nacional Colonizadora-Agricola for the purpose of developing the property on an extensive scale. The waterfalls of El Salto and El Micos, situated upon the land, are to be utilized for the development of approximately 50,000 hp. of electrical energy, according to Lopez. Plans for the construction of the proposed hydro-electric plants and a system of power transmission lines to a number of cities and towns of this part of Mexico are said to be well advanced. An abandoned sugar mill standing upon the property is to be rehabilitated and the sugar-cane industry revived.

A "High" Line in the Coeur d'Alenes.—Construction will begin soon on a very high line (territorially) of the Washington Water Power Company, which will extend 3½ miles in the Cœur d'Alene mining district to the Jack Waite mine. The surveying work is now being done, beginning at an elevation of 4,250 ft. and going over a ridge 5,750 ft. high. The line will rise 1,700 ft. within a mile at one point. The new power line to the Coeur d'Alene mining district from Spokane is being rushed with four crews putting in an entirely new line for a distance of 67 miles. This line is already being operated between Kellogg and Wallace at 60,000 volts, although the entire 67 miles will be at 110,000 volts when completed late this summer, replacing the two old lines at 60,000 volts.

Columbia University Establishes New Scholarship for Electrical Engineering Students.—A scholarship designed to produce electrical engineers trained in the humanities as well as in the fundamentals of their profession has been placed at the disposal of the American Institute of Electrical Engineers by Columbia University, it is announced by Frank D. Fackenthal, secretary of the university. The course is for three years and is on a graduate basis. Only students whose undergraduate work has included considerable work in mathematics, physics and chemistry will be considered by the nominating committee, which will send to the Columbia authorities the name of the successful candidate soon after June 1, the last day on which the Institute will receive applications. Prof. Walter I. Slichter of Columbia, Francis Blossom of Sanderson & Porter and H. C. Carpenter, general manager of the New York Telephone Company, make up the nominating committee.

Nebraska's Rural Lighting Districts Struggling for Existence.—In a final effort to save from complete extinction the Nebraska law enacted in 1921 authorizing farm-land owners to organize rural lighting districts, attorneys for the first district formed, in Saunders County, have filed a motion with the State Supreme Court that it reverse a finding entered April 9 declaring the law invalid. This district has $30,000 bonds outstanding and current indebtedness of $5,000, all of which were invalidated by the decision. It had contracted to purchase energy from the municipal plant at Wahoo, which expended $10,000 to take care of demands. The original law was declared unconstitutional two years ago, because no provision was inserted that would enable a property owner to appeal from a decision of the board that fixed district boundaries, and the court has now held that a validating act passed in 1925 was ineffective because it was an attempt to amend a law that the court had held in effect did not exist without re-enacting all of the old law. The motion for a rehearing is based on the contention that the legislative intent should prevail.

Men of the Industry

Major Anderson Heads New Department

Major Cooper Anderson, for the past fourteen years superintendent of power for the Utah Power & Light Company, Salt Lake City, has been appointed general superintendent of production and transmission of that company. This position was recently created as a result of the constantly increasing scope of the operation of the production and transmission departments. Major Anderson's connection with the Utah Power & Light Company and its predecessors dates back to 1900, when he became general superintendent of the Telluride Power Company's properties in Colorado. In 1907 he was promoted to the position of general superintendent of that organization's properties in Utah, with headquarters at Olmsted. Five years later, when the Utah Power acquired the properties of the Telluride company and various others, he was appointed superintendent of power in charge of generation plants and high-voltage transmission and telephone lines in Utah and Idaho.

H. T. Asbury, formerly chief engineer for the Southwest Power Company, has been appointed manager of that organization at McAlester, Okla.

Myron F. Westover, secretary of the General Electric Company, was elected a member of the board of directors to fill the vacancy caused by the death of E. R. Stettinius of New York.

C. Roy Rook, for the past eight years in charge of the engineering department of the Hygrade Lamp Company, Salem, Mass., has resigned. Mr. Rook will leave for Clermont, Fla., June 1.

W. D. Smith, formerly general superintendent of the Houghton County Electric Light Company, Houghton, Mich., has been transferred to the Galveston (Tex.) Electric Company in the capacity of lighting superintendent. Both these properties are under the executive management of Stone & Webster.

C. W. Stokes, for several years a manager of the Sterling Engineering Company at Montreal, has joined the American Brown Boveri Electric Corporation in Chicago. A graduate of McGill University, Mr. Stokes was previously connected with the English Electric Company, Ltd., as Canadian manager.

H. S. Williamson, who has been connected with the San Bernardino office of the Southern California Edison Company, has been transferred to the Redlands district, and **H. J. Moulton**, Redlands district manager, has been transferred to San Bernardino in place of Mr. Williamson.

L. B. Heatley has been appointed commercial manager of the Western States Gas & Electric Company to succeed Frank E. Cronan, who is now affiliated with the George W. Dunham Company of Utica, N. Y. A few years ago Mr. Heatley was associated with the Denver Gas & Electric Light Company, now the Public Service Company of Colorado.

H. M. Friend has just returned to the Brooklyn Edison Company after a thirteen months' leave of absence spent with Hugh L. Cooper & Company, consulting engineers on the Muscle Shoals development. Mr. Friend attended to the inspection of all wire, cable and insulators for the Wilson Dam power house, supervising and testing the installations.

H. C. Petty a Vice-President of Crocker-Wheeler Company

Herbert C. Petty, who has been elected a vice-president of the Crocker-Wheeler Electric Manufacturing Company, as announced in the May 22 issue of the ELECTRICAL WORLD, is considered

H. C. PETTY

one of the best commercial engineers in the country. A broad background of experience in commercial and sales work, coupled with an extensive knowledge of engineering, which is an unusual combination, eminently qualifies him for his new executive position. A North Carolinian by birth, he was educated at Guilford College, Guilford, N. C., and later did some post-graduate work at Haverford College, Haverford, Pa.

Mr. Petty entered upon his career in the electrical industry at the Lynn works of the General Electric Company, where he remained for about three years. It was in December, 1902, that he affiliated himself with the Crocker-Wheeler company as a sales engineer in the sales department, making his headquarters at Ampere. Subsequently he became assistant sales manager, and later, when he was promoted to be sales manager, he visited various parts of the country, familiarizing himself with local conditions. In 1923 he was elected secretary of the company, which office he will continue to occupy in addition to performing his new duties as vice-president. For many years Mr. Petty has been active in the affairs of the Electric Power Club, having served on the board of governors and as vice-president, and has also been prominent in the Association of Iron and Steel Electrical Engineers.

William B. Herbst, who was affiliated with the Duquesne Light Company for eighteen years, has resigned to become assistant electrical engineer for the Department of City Transit, Philadelphia.

C. S. Fowler has been appointed superintendent of the Cold Spring (N.Y.) Light, Heat & Power Company to succeed Felix D. Neagle, who has been associated with the Cold Spring company for the past sixteen years.

Charles Haydock, formerly principal assistant engineer of the Pennsylvania Railroad Company's water supply systems, has been appointed chief engineer of Gannett, Seelye & Fleming, Inc., engineers.

H. A. Brody, formerly district manager of the Southern California Edison Company at Lindsay, has been appointed district manager at Oxnard to succeed R. C. McFadden, recently transferred to Inglewood. **Carl Elgan**, who has been assistant district manager in Pasadena, has been transferred to Lindsay to replace Mr. Brody.

Julian C. Smith of Montreal was recently elected a director of the Canadian General Electric Company, Ltd. Mr. Smith is vice-president and general manager of the Shawinigan Water & Power Company, president of the United Securities, Ltd., the Montreal Tramways Company, the Quebec Power Company, the Canada Carbide Company and of other subsidiaries of the Shawinigan Water & Power Company.

E. D. Johnstone, formerly resident engineer with the Fred Snare Corporation on the Hudson Avenue station of the Brooklyn Edison Company, has joined the staff of Thomas E. Murray, Inc., in the capacity of resident engineer on its various activities.

C. E. Wilson, general manager of the Remy Electric Company at Anderson, recently returned from Dayton, Ohio, where he had inspected the Dayton Engineering Company's plant, Delco property, of which he has just been made general manager. Mr. Wilson has been designated by the General Motors Corporation as head of both the automobile ignition manufacturing concerns and will divide his time between Dayton and Anderson.

Charles P. Wetherbee, prominent marine engineer, has been retained as consulting engineer on marine work by the Westinghouse Electric & Manufacturing Company, in which capacity he will be attached to the South Philadelphia works. Mr. Wetherbee has earned international fame during his 30 years of service with the Bath Iron Works, Ltd., Bath, Me. The principal part of his engineering career has been devoted to the design of machinery installations, especially those including Parsons marine steam turbines, built by the Bath Iron Works.

Bernard Badrian has joined the staff of the Society for Electrical Development. After leaving school Mr. Badrian spent three years in the testing department of the General Electric Company. He has had wide selling experience, consisting of seven years with the Pacific States Electric Company and seven years as district manager for the Hurley Machine Company

on the Pacific Coast. After severing his connection with the latter company Mr. Badrian became a manufacturer's agent. His special work with the society will be in connection with the furtherance of the "red seal" plan to assure adequate wiring.

Theodore P. Federer has been appointed commercial manager of the Adirondack Power & Light Corporation, Schenectady, N. Y. Mr. Federer has had a broad background of experience in commercial work, having been for sixteen years connected with public utility sales organizations. His first connection of this kind was with the Mexico Light, Heat & Power Company, Mexico City, and later he joined the selling organization of the General Electric Company, in which capacity he came in close contact with utility organizations. His most recent affiliation was with the Cohoes (N. Y.) Power & Light Corporation, where he held the position of sales and commercial manager.

W. B. Miser, formerly connected with the Fayetteville (Ark.) office of the Southwest Power Company, has been transferred to McAlester in the capacity of general commercial manager.

Edward S. Hageman has been appointed superintendent of electrical construction for the Wisconsin Power & Light Company's power plants and substations in the eastern division.

Solon D. Rider, assistant vice-president and secretary of the W. B. Foshay Company, has joined the sales organization of the Minneapolis office of S. W. Straus & Company. Mr. Rider has been connected with the Foshay company for the past seven years.

F. J. Sensenbrenner was elected president of the Spruce Falls Power & Paper Company, Kapuskasing, Ontario, recently organized, and **J. H. Black** was elected vice-president and general manager. **Ernest Mahler** was made secretary and **J. C. Kimberley** treasurer.

R. C. McFadden, formerly district manager of the Southern California Edison Company at Oxnard, has been transferred to the Inglewood office in the same capacity. Mr. McFadden is succeeding P. S. Minner, whose ill health necessitated a leave of absence.

Snowden M. Hunt has been appointed director of public relations of the Southwestern Power & Light Company, Lawton, Okla., and **L. H. Clegg,** for several years connected with the Oklahoma City *Times*, has been appointed advertising manager.

J. G. Oliver has been appointed superintendent of the Greensboro district of the Georgia Railway & Power Company. The distributing system in Greensboro was recently taken over by the Georgia Railway & Power organization.

E. T. Gray, formerly superintendent of the distribution department of the Depew & Lancaster Light, Power & Conduit Company, Lancaster, N. Y., has joined the engineering department of the Central Hudson Gas & Electric Company, Poughkeepsie, N. Y.

George A. Wieber, for more than a year assistant commercial manager of the Utica (N. Y.) Gas & Electric Company, has been appointed commercial manager of that organization. Mr. Wieber affiliated himself with the Utica utility in the summer of 1919 as power engineer, subsequently being made manager of the heating division. A graduate of the Polytechnic Institute of Brooklyn, N. Y., Mr. Wieber served for a brief period as apprentice engineer with the Westinghouse Machine Company of East Pittsburgh and later as chief tester for the New York Edison Company.

C. W. Amidon Made Vice-President of Nebraska Utility

Charles W. Amidon, until recently a division manager of the Central Illinois Public Service Company, has been made vice-president of the Central Power Company with headquarters at Grand Island, Neb. He entered the service of the Illinois utility in 1912 as superintendent, being made a division engineer three years later. Following two years of military service he again affiliated himself with the Illinois company as chief clerk of one division and was promoted to be division manager in 1922, which position he recently left to take up his present executive duties with the Central Power Company.

C. W. AMIDON

C. H. Dinsmore has been named district manager of the Wisconsin Power & Light Company's new district, with headquarters at Tomah. This district embraces the cities of Tomah, Cazenovia, Wonewoc, Elroy and New Lisbon and a score of smaller urban and rural communities.

J. S. Boyett has been appointed district manager of the Southwestern Light & Power Company, with headquarters at Lawton, Okla. **A. D. Kerr** has been appointed district manager at Altus, and **R. W. Porter** has established headquarters at Elk City in the same capacity.

D. H. Kirk, formerly superintendent of distribution of the Brush Electric Company of Galveston, which was recently taken over by the Galveston Electric Company, has been appointed superintendent of distribution in the electric department of the Baton Rouge Electric Company.

W. R. Schmidley, who has been with the Wisconsin Power & Light Company in charge of its electric properties in Janesville first as general superintendent in 1920 and district manager in 1921, will be transferred to the general offices of the company at Madison.

Norman Lee has recently joined the American Brown Boveri Electric Corporation at Camden, N. J. Following graduation as an electrical engineer from the University of Wisconsin, Mr. Lee spent ten years abroad with the French Thomson-Houston Company, Paris. After discharge from military service in the A. E. F. he designed and manufactured transformers under his own name. In 1923 he returned to the United States and joined the Allis-Chalmers Manufacturing Company as a designer of power transformers.

E. E. Scofield has been made industrial engineer for the Washington Water Power Company, Spokane.

Louis Hausmann, formerly connected with the general engineering department of the South Philadelphia works of the Westinghouse Electric & Manufacturing Company, has been appointed a power engineer in the Chicago district office of the company.

Peter A. Sensenig has joined the publicity staff of the Ingersoll-Rand Company, New York. Mr. Sensenig was previously employed for eight years in the Westinghouse department of publicity and was stationed successively at East Pittsburgh, Atlanta, Philadelphia and New York.

Obituary

G. Franklin Smith, sales manager of the Iowa Service Company at Red Oak, Iowa, died May 19 as the result of pneumonia. He was only 24 years of age.

Henry D. Whitcomb, vice-president of the Public Service Electric & Gas Company in charge of gas operation, died May 8 in his office in Newark, N. J. Death was caused by a cerebral hemorrhage. Mr. Whitcomb was 56 years of age and had been associated with the public utility companies in Newark since 1901.

Jacob Bunn, president of the Sangamo Electric Company, died May 10 at the age of 61, following an illness of many months. Mr. Bunn has been identified with the electrical industry for about 30 years. He and R. C. Lanphier became interested in the Gutmann patent on an electric meter, and in 1899 they organized the Sangamo Electric Company to manufacture meters. Mr. Bunn has been president continuously since that time. He was also president of the Illinois Watch Company and the Springfield Marine Bank.

Sir Henry C. Mance, past-president of the British Institution of Electrical Engineers, died at Oxford, England, April 21 in his eighty-fifth year. Sir Henry's early experience was with the Electric & International Telegraph Company, but in 1863 he joined the Persian Gulf Telegraph Expedition, remaining with the system until 1885, when he retired from service. Among his contributions to electrical invention were a method of locating faults in ocean cables and a method of testing the internal resistance of electric batteries.

Commission Rulings

Engineering and Management Charges Found Excessive.—A finding that a management fee of 5 per cent of gross revenues to be paid by the Northwestern Public Service Company to its holding company, the National Electric Power Company of New Jersey, an Albert Emanuel corporation, taken in connection with a 15 per cent charge for engineering and 2 per cent additional for accounting and administration, made up charges that were "excessive and go far beyond those claimed by any of the other utilities coming within our jurisdiction" has been made by the Nebraska State Railway Commission in passing upon an application for modification of a security issues order. As the management fee is charged as an operating expense and is connected with rates, over which the commission has no jurisdiction, no order was made with respect to it, the fee being considered only in determining whether the percentage for engineering, which is partly a duplication of the management fee asked for was reasonable. The company maintained that services to the full value of the charges were rendered. The engineering services were performed by the Electric Management & Engineering Corporation, a subsidiary of National Electric Power. The commission fixed 7½ per cent as the total engineering charge. The commission has amended a previous ruling that a margin of 25 per cent as between bonds and plant values is required to provide that the discount on $700,000 6 per cent bonds just authorized, which discount is to be amortized, shall be added to the assets of the company. The amortization fund must be reinvested in the plant, and the commission provides that the face value of the bonds shall not exceed 75 per cent of the additions and betterments plus the reinvested amortization discount.

Valuation of Water-Power Rights.—A valuation of water rights based on capitalizing an alleged saving made in generating electricity by a hydro-electric plant over the cost of generation by a steam plant was rejected in a case affecting the Gage County Electric Company by the Nebraska State Railway Commission, which said: "Applicant proposes to buy the water rights from Black Brothers' flour mills for $102,789. This figure is arrived at by comparing the cost of producing 3,250,000 kw.-hr. per annum by a steam plant and its production cost with the present hydro-electric generating plants aided by internal-combustion engines. Applicant figures that it will save $7,709 per annum by use of its present equipment as compared with the hypothetical steam plant and by capitalizing this amount at 7½ per cent arrives at the value stated above. The cost of making energy by steam plant, as used in the above computations, is 2.853 cents per kilowatt-hour. The use of this cost figure in arriving at the value of the water rights is faulty if applicant could buy its energy from other companies for less than that figure. The record is silent on the possibility, but it is well known that a large hydro-electric plant is situated at Barnston which could probably sell, at a profit to itself, to applicant for less than this figure representing cost of production by steam plant. A second fault to be found with the computations is that applicant is bound by long-time contract to sell most of its energy wholesale at 2½ cents per kilowatt-hour. It should not claim in water-power value a profit which its contracts forbid it to get." The water rights and the going value were jointly valued at $60,000 by the commission, which said that it was difficult to separate the two intangibles.

Recent Court Decisions

Watchman Killed in Trying to Remedy Electrical Trouble Not Guilty of Contributory Negligence.—In Dunagan vs. Appalachian Power Company damages were sought for the death of a watchman who, finding serious electric disturbance on the lines of the power company, by which he was employed, sought to pull a switch that would turn off the current and was killed by contact with escaping electricity. The trial judge had directed a verdict for the defendant company on the ground that the watchman took an unnecessary risk, no life being in immediate danger, and was guilty of contributory negligence. The United States Circuit Court of Appeals in West Virginia reversed this finding and ordered a new trial, saying that if the company's negligence was established, the widow of the watchman, killed in an endeavor to perform his duty of protecting his employer's property, was clearly entitled to recompense. (11 Fed. (2d) 65.)*

Condemnation Proceedings Not to Be Voided Because Part of Use of Transmission-Line Will Be Non-Public in Nature.—Holding that the necessity of a new electric power transmission line for public purposes is a legislative, not a judicial, question and that, in absence of abuse of power, a court cannot interfere with the determination of a corporation authorized to exercise eminent domain that public exigencies require a new route for a transmission line, the Supreme Judicial Court of Maine, in Smith vs. Western Maine Power Company, held that a decree of a lower court voiding the condemnation proceedings was not authorized. This decree had been entered on the ground that some of the purposes of the line were not public, but since part of the purpose was to give electric light, the Supreme Court held that the condemnation was legal and that to prevent unauthorized use of electrical energy an injunction would be the proper remedy. (132 At. 740.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Too Broad Powers Take Petitioning Company Out of Classification as Electrical Corporation.—Under this heading the ELECTRICAL WORLD on March 20 (page 630) recorded the refusal of the New York Public Service Commission to grant authority to the New York-New Jersey Superpower Connecting Corporation to exercise franchises and begin construction of a transmission system on the ground that it was not an electrical corporation within the meaning of the law. The company brought suit against the commission in the New York Supreme Court to compel it to change its ruling, but the court unanimously confirmed the finding. The court said: "The petitioner does not own, operate or manage an electric plant and therefore does not fall within the [legal] definition. It has no property. It does not appear that it has engaged in any activity. Its present application to the commission was verified Dec. 27, 1924, twelve days after its incorporation. From such application it appeared that the petitioner had 'not as yet undertaken any operation' and that there had been 'no stock issued.' At most, the petitioner has the right in the future to become an electrical corporation. It is not such merely because its certificate of incorporation gives it that right, in common with the right to engage in numerous other enterprises. It may adopt any one of the latter and ignore the former. . . . It is suggested that the relator is a stock corporation other than a gas or electrical corporation. There are provisions relating to the acquisition by such stock corporation of the stock of a gas or electrical corporation with the consent of the commission, but such provisions clearly do not apply to this case, nor does the relator so contend. Its sole contention is that it is an electrical corporation." (214 N. Y. S. 294.)

Invasion of Territory and Unoccupied Fields.—In its judgment in the suit of the Illinois Power & Light Corporation vs. Commerce Commission, in which a rehearing has been denied (see ELECTRICAL WORLD for April 3, page 731), the Supreme Court of Illinois overrules the lower court, which sustained the commission's action in permitting the Consol Power Company to enter a field claimed by the Illinois Power & Light. The Supreme Court holds that the latter company was fully equipped to serve all consumers in the territory in dispute and that legal means existed for compelling it to do so. Only in case of its failure could the commission issue a certificate to another, and the commission's action in granting one to a company organized only to provide means of disposing of a temporary excess of electrical energy used by a coal company was improper. The fact that the existing power company's certificate limited its service to the territory within half a mile of its transmission line and that the territory which it was sought to bestow upon the Consol company was beyond this limit did not deprive the Illinois Power & Light of interest in the matter, since the commission could extend the company's territory on the latter's application or without it. (151 N. E. 236.)

Financial and Corporate

Utility Market Improves

Bonds and Preferred Stocks Lead in Moderate Betterment for Investments

IN THE week under review the general tone of the securities market improved and the utility group enjoyed its full share of the advance. Special attention must be called to the increasing demand for issues that offer a fixed investment return. That doubtless accounts for the strength in power and light bonds and preferred stocks.

Authorities seem to agree that the supply of funds at reasonable rates is likely to continue for a period, but the ease in money is having its influence primarily on the investment issues. Within the last ten days a new interest has developed, however, in the common stocks of improving quality, and advances of a point or two may be noted in many sections of the list.

Among the preferred stocks that advanced about a point during the period may be mentioned Adirondack Power & Light Company preferred, American Public Utilities participating and also the prior preferred, Associated Gas & Electric preferred, Kansas Gas & Electric preferred, Middle West Utilities preferred, Northern Texas Electric preferred and United Light & Power, class B preferred.

Except for a 4½-point advance in United Gas Improvement, a rally in American Water Works & Electric Company's stock to a position above 50 and a three-point gain in Electric Bond & Share Company, the improvement in the common stocks was relatively small. Commonwealth Power Corporation, Commonwealth Edison, Southeastern Power & Light and American Light & Traction each added about a point to their positions of a week ago.

Annual Report of Standard Gas & Electric Company

The annual report of the Standard Gas & Electric Company for the year ended Dec. 31, 1925, shows that the period was a marked success from an operating and earnings viewpoint. Gross revenue for the year amounted to $7,270,116 as compared with $6,098,532 for the previous year, and net revenue totaled $7,125,669 against $5,981,260 in 1924. The operated companies, as a whole, had a satisfactory year and in every case showed a larger percentage of increase in net earnings than in gross earnings, thus evidencing continued operating economies. Combined gross earnings of the operated utility companies, including all companies now in the system, amounted to $66,917,200 as compared with $61,787,671 in 1924, an increase of 8.3 per cent, and net earnings amounted to $29,701,244 against $26,165,447 in 1924, an increase of 13.51 per cent over the preceding year. Of the gross earnings 73.27 per cent and of the net earnings 86.11 per cent were derived from the sale of electricity.

During the year the total number of customers supplied with various kinds of service increased from 943,644 to 1,011,779, and the total connected load from 1,558,345 kw. to 1,732,286 kw. Total output of electrical energy for the year was 1,970,643,085 kw.-hr., an increase of 10.67 per cent. During 1925 a total of $18,766,531 was invested in new construction. The total number of stockholders at the close of 1925 was approximately 27,200, or an increase of 6,600 during the year.

Southern California Edison to Float Large Issue

A forty-million-dollar bond issue will be offered in about a month by the Southern California Edison Company according to present plans, this offering marking the first major bond financing of the company in several years. The purpose of this issue of 5 per cent bonds is to replace outstanding issues with new securities bearing a lower rate of interest, thereby effecting substantial savings.

Company Reports

Name of Company	Gross Earnings for April 1926	1925
Adirondack Power & Light	$747,343	$647,636
Alabama Power	1,012,182	841,411
American Power & Light*	4,772,118	4,026,917
Bangor Hydro-Electric	139,206	127,327
Columbia Gas & Electric	3,390,853	2,917,250
Commonwealth Power	4,031,318	3,570,361
Consumers Power	999,093	784,244
Detroit Edison†	3,527,328	2,935,950
Federal Light & Traction*	571,741	496,259
Fort Worth Power & Light*	232,668	226,220
Kansas City Power & Light	926,305	839,609
Kansas Gas & Electric*	364,187	543,361
Massachusetts Lighting	322,004	288,008
Nebraska Power*	342,359	329,125
Northern Ohio Power	1,017,129	950,147
Pacific Power & Light*	276,878	263,705
Portland Electric Power	948,005	908,016
Southern Canada Power	115,186	101,158
Tennessee Electric Power	982,169	970,285
Texas Power & Light*	566,494	521,673
Utah Power & Light*	855,512	809,341

* March. † Includes other revenue.

Duke-Price Power Company, Ltd.

New Thirty-Seven-Million-Dollar Bond Issue Is Protected by Contracts That Provide Enough Revenue to Cover Operation and Interest Charges

BY PAUL WILLARD GARRETT
Financial Editor *New York Evening Post*

ORGANIZED in 1924 by the late James B. Duke and Sir William Price, the Duke-Price Company, Ltd., is one of the lowest-cost producers in North America. The plant is located on the Saguenay River at Ile Maligne, Province of Quebec, at the outlet of Lake St. John.

Several interesting features of the company's development that had not been generally known before were brought out in connection with the flotation recently of a thirty-seven-million-dollar bond issue. As a result of negotiations that were made following the death of Mr. Duke, the Aluminum Company of America is acquiring 53⅓ per cent of the company's capital stock, the Shawinigan Water & Power Company 20 per cent, and the remaining 26⅔ per cent is being retained by the Duke-Price interests. The capital structure of the company will be simple on completion of the present financing and will consist of only two classes of securities—namely, an issue of first mortgage 6 per cent bonds, due in 1966, totaling $37,000,000 and 210,000 shares of capital stock.

The bonds are a direct first mortgage on the entire physical property now owned by the company and including the plant at Ile Maligne, which is one of the largest hydro-electric stations on the continent. Including two units shortly to be completed, the installed capacity consists of ten units aggregating 450,000 hp., and the station has been constructed to permit installation at an estimated cost of less than a million dollars of two additional units that would make the ultimate capacity 540,000 hp.

The company has firm contracts for the sale of 330,000 hp. as follows: Aluminum Company of America, 100,000 hp. for a period of 50 years; Shawinigan Water & Power Company, 100,000 hp. for a period of 50 years; Price Brothers & Company, Ltd., 40,000 hp. for 50 years and 60,000 hp. for ten years, and the Port Alfred Pulp & Paper Corporation, 30,000 hp. for 25 years.

Payments required by the 50-year contracts amount to $2,055,000 in 1927, $2,330,000 in 1928, $2,605,000 in 1929 and $2,880,000 in 1930 and annually thereafter. Payments on the 25-year and ten-year contracts aggregate $855,000 additional. Since the company's total expenses exclusive of interest charges should be covered by less than $225,000 in 1927 and $275,000 by 1930, it must be plain that the amounts assured through performance of the contracts leave a wide margin of earnings applicable to interest requirements. It is reckoned that the revenue assured through these contracts will exceed all operating expenses and interest charges by more than $400,000 in 1927, $725,000 in 1928, $975,000 in 1929 and $1,250,000 in 1930. In these estimates no account

is taken of sources of revenue beyond the existing contracts specifically mentioned.

New Capital Issues

To retire certain indebtedness and for extensions and improvements the Washington Water Power Company made an offering during the past week of general mortgage gold bonds to the amount of $5,000,000.

General and refunding mortgage gold bonds of the Northern Ohio Power & Light Company were offered at 92½ and interest, yielding 6.09 per cent, a bit of financing involving $8,500,000. The Old Dominion Power Company, Norton, Va., issued first mortgage 5 per cent gold bonds amounting to the sum of $2,500,000, the price being 94 and interest.

The Galveston-Houston Electric Company issued 6½ per cent secured gold notes, series A, totaling $2,000,000, the price being 97.92 and accrued interest, to yield about 7 per cent.

The Interstate Power Company of Delaware offered first mortgage 6 per cent gold bonds amounting to $2,700,000 at 100 and accrued interest.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Saturday May 22	Low 1926	High 1926
STOCKS			
ABITIBI PWR. & PAPER, com. —no par	k 72½	70½	84½
Adirondack Pwr. & Lt.—7% pf.	k103	....	....
Adirondack Pwr. & Lt.—8% pf.	109	108	110
Ala. Pwr., pf.	k105½	....	....
Allis-Chalmers Mfg. pf.	109½	105	110
Allis-Chalmers Mfg., com.	k 81	78½	94½
Aluminum Co. of Amer., com.	k 93	....	....
Aluminum Co. of Amer. new, pf.	k 99½	98½	101
Amer. & Foreign Pwr., pf. 25% pd.	m108	108	131
Amer. & Foreign Pwr., 7% pf.—no par	90	89	98
Amer. & Foreign Pwr., com.—no par	k 18½	15½	42½
Amer. Bosch Magneto, com—no par	k 17½	16	34½
Amer. Brown Boveri, Elec.	k 34½	30½	48½
Amer. Brown Boveri Elec pf.	k 95	86½	97½
Amer. Elec. pwr., pf.	c110½	102½	111½
Amer. Gas & Elec., 6% pf.—no par.	k 91½	....	....
Amer. Gas & Elec., com.—no par.	k 73	64	99½
Amer. Lt. & Trac., 6% pf.	k106	114½	115½
Amer. Lt. & Trac., com.	k207½	195	263
Amer. Pwr. & Lt., 6% pf.	k 93½	92	96
Amer. Pwr. & Lt., com.—no par	k 52	50½	53½
Amer. Pub. Serv., 7% pf.	k 94	....	....
Amer. Pub. Serv., com.	47	45	80
Amer. Pub. Utilities, 6% pf.	k 87	....	....
Amer. Pub. Utilities, 7% pf.	k 90	....	....
Amer. Pub. Utilities, com.	70	80	82
Amer. States Sec., A.	k 2½	....	....
Amer. States Sec. B.	k 2½	....	....
Amer. Superpwr., pf.—25	24½	23	26½
Amer. Superpower, pf.	92	90	94
Amer. Superpwr., Class A—no par.	21½	19½	37½
Amer. Superpwr., Class B—no par.	k 23½	21½	39
Amer. Wtr. Wks. & Elec., 7% pf.	103	101½	108½
Amer. Wtr. Wks. & Elec., com.—20.	k 51	43½	74
Anaconda Copper.	k 45½	41½	51
Appalachian Pwr., 7% pf.	100	99	101
Appalachian Pwr., 1st pf., 7%	100	99	101
Appalachian Pwr., com.	80	80	83
Arizona Pwr., 7% pf.	k 78	....	....
Arizona Pwr., com.	m 27	27	35½
Arkansas Cent. Pwr., pf., $7—no par	103	99	102
Arkansas Lt. & Pwr., 7% pf.	98	....	....
Arkansas Lt. & Pwr., com.	100	110	115
Asheville Pwr. & Lt., 7% pf.	f106	100½	105½
Assoc. G.&E., pf.—$3.50—50	k 60	....	....
Assoc. Gas & Elec., pf.—$6—no par	k 83½	....	....
Assoc. Gas & Elec., Class A—no par	k 29½	25½	35½
BABCOCK & WILCOX, com.	k113	....	....
Binghamton Lt., Ht. & Pwr., pf.	105	....	....
Birmingham Elec. pf.—$7—no par.	103	101	103½
Blackstone Valley Gas & Elec., pf.	92	90	106
Blackstone Valley G.&E., com.—50.	95	....	....
Blaw-Knox, com.	i 52	45	56
Brazilian Trac., Lt. & Pwr., com.	f 96	....	....
Broad River Pwr., pf.	k 93½	....	....
Brooklyn Edison, com.	140	133	146½
Buffalo, Niagara & East. Pwr., pf.—25	k 24½	....	....
Buffalo, Niagara & Eastern Pwr., com.—no par.	k 26½	....	....
CALIFORNIA ELEC. GENERATING, pf.	93	89	93
California Ry. & Pwr., pf.	105	88	115
Carolina Pwr. & Lt. pf.—$7—no par	104	102	107
Cent. & S. W. Ut. 7% pf.—no par	a 90½	89½	95½
Cent. & S. W. Ut., pr. in. pf.—no par	a 94	94	100
Central Ariz. Lt. & Pwr., pf.	102	....	....
Central Ark. Ry. & Lt., 7% pf.	k 98	....	....
Central Ill. Pub. Serv., 6% pf.	88	89	91
Central Ind. Pwr., 7% pf.	88	88	93½
Central Pwr. & Lt., pf.	96½	94	98½
Central States Elec., 7% pf.	k 92	....	....
Central States Elec., com.	m200	200	230
Century Elec., com.	b115	110	116
Chicago Fuse Mfg., com., no par...	m 32	30½	35
Cincinnati Gas & Elec., com.	g 89½	88	93½
Cities Service, 6% pf.	85½	82½	85½
Cities Service, pf. B—10.	7½	7½	7½
Cities Service, pf. BB—100.	m 74	74	76
Cities Service, com.—20.	40½	37½	42½
Cities Service, Bkr. Shrs.—10.	k 20	....	....
Clarion River Pwr., pf.	93	93	95
Cleveland Elec. Illg., 6% pf.	105	103	105½
Cleveland Elec., Illg., com.	k225	....	....
Colorado Pwr., 7% pf.	k 95	....	....
Columbia Gas & Elec., 7% pf.	k112½	112	115
Columbia Gas & E., com.—no par.	k 78½	63½	90
Columbia Ry., Gas & Elec., 6% pf.	90	65	96
Columbus Elec. & Pwr., 2d pf.	k103	....	....
Columbus Elec. & Pwr., com.	k250	....	....
Columbus Ry., Pwr. & Lt., 1st. pf.	98	98	99
Columbus Ry., Pwr. & Lt., pf. B.	95	92	95
Col. Ry., Pwr. & Lt., com.—no par.	75	82	85
Commonwealth Edison, com.	a139	137½	144
Commonwealth Pwr., 6% pf.	k 85½	....	....
Commonwealth Pwr., com—no par.	k 34½	28½	42½
Conn. Lt. & Pwr., 8% pf.	116	117	121
Conn. Lt. & Pwr., 7% pf.	107	108	113
Cons. Gas of N. Y., pf.—50.	k 57½	....	....
Cons. Gas of N.Y., com.—no par.	k 93½	87	104½
Cons. Gas Elec. Lt. & Pwr. of Balti., 6% pf.	104	102	105
Cons. Gas, Elec. Lt. & Pwr. of Balti 6½% pf	c111	108½	111
Cons. Gas, Elec. Lt. & Pwr. of Balti. 7% pf.	c112½	109	112½
Cons. Gas, Elec. Lt. & Pwr. of Balti. 8% pf.	c127½	124	128½
Cons. Gas, Elec. Lt. & Pwr. of Balti. com.—no par.	e 49½	45	57½
Cons. Pwr. & Lt., 7% pf.	104	100	107
Consumers Pwr., 6% pf.	97½	95	98
Consumers Pwr., 6.6% pf.	104	101½	103½
Continental Gas & Elec., 7% ptc. pf	k 97	....	....
Continental Gas & Elec., 7% pr pf.	k 98	....	....
Continental G.&E., com.—no par...	105	85	150
Crocker Wheeler, com.	14	14	19
Crocker Wheeler, pf.	50	50	55
DALLAS PWR. & LT., 7% pf.	102	102	104
Dayton Pwr. & Lt., 6% pf.	99	95	97
Detroit Edison, com.	k130½	123½	141½
Dubilier Condenser & Radio, com. no par.	k 5½	4½	11
Dubuque Elec., 6% pf.	98	93	97
Duquesne Lt., 7% pf.	114	111½	116½
EAST, N. Y. UTIL, pf.	80	80	85
Eastern New York Util., com.	65	70	75
Eastern States Power.	14	23	32½
Eastern States Pwr., pf.	k 86	....	....
Eastern Tex. Elec., 7% pf.	k103	....	....
East. Tex. Elec., com.—no par.	75	103	107
Edison Elec. Illum. of Boston, com.	d219	207	250
E. Paso Elec., com.—no par	70	70	94
E. Paso Elec. pf.	102	102	104
Elec. Bond & Share, 6% pf.	f106	103½	107½
E. Bd. & Share Sec., com.—no par.	f 67½	56½	86
El. Household Util.	a 16	13½	25
Elec. Investors, 6% pf.—no par.	87	92	95
Elec. Investors, com.—no par.	33	30½	74½
Elec. Investors, 10% pd. receipts.	10	....	....
Elec. Pwr. & Lt., ctfs., pf.	k 93	89½	97½
Elec. Pwr. & Lt., ctfs., 40% pd.	k100½	99½	115
Elec. Pwr. & Lt., ctfs. full pd.	103	103	110½
Elec. Pwr. & Lt., ctfs., com.—no par	x 18½	15½	34½
Elec. Ry. Securities, com.—no par.	m6	4½	10
Elec. Refrig.	k 65½	62	67½
Elec. Storage Battery, com.—no par.	k 77	71½	79½
Elmira Wtr., Lt. & R. R., 7% pf.	98	97½	99½
Emerson Elec. pf.	m103	100	104½
Empire Dist. Elec., 6% pf.	80	80	85
Empire Pwr., A.	k 32	21	32
Eng. Pub. Serv., pf.—no par	102	99½	104½
Engr. Pub. Serv., com.—no par.	k 23½	21	29½
Eureka Vac. Cleaner, com.—no par...	46½	43	53½
FAIRBANKS MORSE, com—no par	k 48½	46	59½
Fairbanks Morse, pf.	115	108½	116
Federal Lt. & Trac., com.	k 30	28	39½
Federal Light & Traction, pf.	85½	87	89
Federal Utilities, pf.	k 70	....	....
Federal Utilities, com.	k 17	....	....
Ft. Worth Pwr. & Lt., 7% pf.	f106	105	108
GALVESTON-HOUSTON ELEC., 6% pf.	k 44	....	....
Galveston-Hstn El., com.	k 14	14	21
Gen Elec., w.i.	k 79½	r 76½	83½
Gen. Elec., com.	k317	285	386½
Gen. Elec., special—10.	k 11½	11	11½
Gen. G.&E., (Del.) com. A no par.	k36½	34	59
Gen. G.&E., (Del.) com. B no par.	k 31	....	....
Gen. G.&E., (Del.) A pf. $8—no par	107	105½	110½
Gen. G.&E., (Del.) A pf. $7—no par	96	95	99½
Gen. G.&E., (Del.) B pf.	94	92½	96
General Public Service, pf.	90½	90	106½
General Public Service, com.	13½	12½	16½
Ga. Lt., Pwr & Rys., 6% pf.	84	82	85
Ga. Lt., Pwr. & Rys., com.	m 57½	56½	73½
Ga. Ry. & Pwr., 8% pf.	110	112	114
Ga. Ry. & Pwr., 7% pf.	100½	101½	103
Ga. Ry. & Pwr., 4% pf.	m133	....	....
Ga. Ry. & Pwr., com.	k115	....	....
Gt. Western Pwr., 7% pf.	k100½	....	....
HAVANA ELEC. UTIL., com.	39	37½	44½
Havana Elec. Util., pf.	72	64½	72
IDAHO PWR., 7% pf.	102	103	104
Ill. No. Utilities, 6% pf.	a 91½	90	92
Ill. Pwr. & Lt., 7% pf.	k 97	....	....
Ingersoll Rand.	91½	80½	104
Int. Combus. Engr., com.—no par.	k 52½	33½	64½
Int. Utilities, class A—no par.	k 30	....	....
Int. Utilities, class B—no par.	k 4½	4½	9½
Interstate Pwr., pf., $7 no par.	k 93	....	....
Interstate Pub. Serv., 7% pf.	96	96½	97
Iowa Ry. & Lt., 7% pf.	95	98	100
JERSEY CENTRAL PWR. & LT. 7% pf.	94	95	97½
Jersey Central Pwr. & Lt., ptc. pf.	95½	95½	96½
Jersey Central Pwr. & Lt., com.—no par.	45	45	50
Johns-Manville, com.—no par.	k141½	130	153
KANSAS CITY PWR. & LT., pf.	110½	107½	111
Kansas Gas & Elec., 7% pf.	l101½	99	102
Kentucky Hydro-Elec., pf.	a 93	91½	95
Kentucky Sec., 6% pf.	77	75	77
Kentucky Sec., com.	100	90	100
Kentucky Utilities, 6% pf.	92	90	95
Keystone Pwr. & Lt. 7% pf.	95	95	97
Kings County Ltg., 7% pf.	102	101	106
Kings County Ltg., 8% pf.	102	105	108
LACLEDE GAS LT., com.	152½	146	168
Lehigh Pwr. Sec., com.—no par.	k 13	10	23
Long Island Ltg., 7% pf.	106	105	107
Long Island Ltg., com.—no par.	115	120	150
Los Angeles Gas & Elec., 6% pf.	k 96	....	....
Louisville Gas & Elec., Class. A.	k 24	22½	26½
MANHATTAN ELEC. SUPPLY	k 73½	56	76½
Manila Elec., com.—no par.	39	27½	39½
Maytag Mfg., com.	k 20½	19	23½
Memphis Pwr. & Lt., pf., $7, no par	104	103	105
Metro. Edison, pf.—$6—no par.	k 92	....	....
Metropolitan Edison, pf., $7, no par.	103	102	106
Metropolitan Edison, com., no par.	45	45	50
Middle West Utilities, 7% pf.	a104½	97½	111½
Middle West Utilities, 7% pr. lien pf.	a115½	106½	123½
Middle West Utilities, com.—no par.	a111	108	134½
Midland Utilities, pr. in. pf.	a 98½	98	100
Midland Utilities pf. A	a 96	96	98
Milwaukee Elec. Ry. & Lt., 7% pf.	100	....	....
Milwaukee Elec. Ry. & Lt., 6% pf.	91	....	....
Minn. Pwr. & Lt., 7% pf.	l102½	100	103½
Miss. Pwr. & Lt., pf.	k101	....	....
Miss. River Pwr., 6% pf.	93	94	96
Miss. River Pwr., com.	k 60	....	....
Mohawk Hudson Pwr., 1st pf.—$7—no par.	101	101	105
Mohawk Hudson Pwr., 2nd pf.—$7—no par.	k 94	....	....
Mohawk Hudson Pwr., com.—no par	k 22	....	....
Montana Pwr., pf.	m114½	112½	119½
Montana Pwr., com.	76½	69½	83½
Montreal Pwr., com.	f 224	....	....
Mountain States Pwr., pf.	k 96	....	....
Mountain States Pwr., com.	k 20	....	....
NASSAU & SUFFOLK, LTG., pf.	96	93	95
National Carbon, pf.	a127½	125	128
National Elec. Pwr., pf.	m100	93	95
National Electric Pwr-A	a 21½	10½	26
Nat.-Lt., Ht. & Pwr., com.—no par.	24	22	25
National Lt., Ht. & Pwr., 5% pf.	72	71	73
National Pwr. & Lt., pf., $7—no par.	k100½	96	102½
National Pwr. & Lt., com.—no par..	k 19½	16½	38½
National Pub. Serv., 7% pf.	90½	90	94
National Pub. Serv., pfc. pf.	95½	96	97½
National Pub. Serv., A com.—no par	19	15½	24
National Pub. Serv., B com.—no par	10½	10	12½
Nebraska Pwr., 7% pf.	f105	103	105½
Nevada-Calif. Elec., com.	m 23	18½	44½
New Brunswick Pwr., pf.	35	30	40
New England Pub. Serv., pr. in. pf.	97	98	99½
New England Pub. Serv., pf.	88	95½	97
N. J. Pwr. & Lt., 7% pf.	105	104	108
New Orleans Pub. Serv., 7% pf.	101	100	102
N.Y.& Queens Elec.Lt.& Pwr.,5% pf	88	89	90
N. Y. Central Elec., 7% pf.	96	98	100
Newport News & Hampton Ry., Gas & Elec., com.	110	108	112
Newport News & Hampton Ry., Gas & Elec., pf.	110	109	114
Niagara Falls Pwr., 7% pf.—25.	28½	27½	28½
Niagara, Lock. & Ont. Pwr., 7% pf.	108	110	111½
Niagara, Lock. & Ont. Pwr., com.—no par.	m 60½	n 60	n 73
No. Amer., 6% pf.—50.	k 50½	49	50½
No. Amer., com.—10.	k 49	42	67
No. Amer. Edison pf.—no par.	90	93	95
No. Amer., Lt. & Pwr., pf.	95	88	90
No. American Utilities, pf., full pd.	m 94½	89	96
No. American Utilities, pf., 25% pd.	m 19	18	27
N.C. Pub. Serv., pf.—$7—no par.	k 90	....	....
Northeastern Pwr., com.	k 19	17½	36½
No. Indiana Gas & Elec., pf. A.	96	98	100
No. N. Y. Utilities, 7% pf.	k102½	....	....
No. Ohio Pwr., com.—no par.	k 13½	11	26½
No. Ohio Trac. & Lt., 6% pf.	75	78	81
No. Ohio Trac. & Lt., 7% pf.	85	88	91
No. Ont. Lt. & Pwr., pf.	k 78	....	....
No. Ont. Lt. & Pwr., com.	72	45	70
No. States Pwr., 7% pf.	k100½	....	....
No. States Pwr. com.	100½	98½	136½
No. Texas Elec., 6% pf.	k 44	....	....
No. Texas Elec., com.	k 20	....	....
OHIO BRASS, com. B—no par.	74	70	79
Ohio Brass, pf.	100	98	101
Ohio Gas & Elec., 7% pf.	92	92	95
Ohio Pwr., 6% pf.	94	93	95
Ohio Pub. Serv., 6% pf.	90	90	93
Ohio Pub. Serv., 7% pf.	98½	98½	100
Ohio River Edison, pf.	99	99½	101½
Oklahoma Gas & Elec., pf.	k 96	....	....
PACIFIC GAS & ELEC., 6% pf.	k 97½	....	....
Pacific Gas & Elec. com.	120	118	132½
Pacific Pwr. & Lt., 7% pf.	l 99	98	101½
Parr Shoals Pwr., 6% pf.	92	....	....
Penn Central Lt. & Pwr., pf.—no par	c 72	71	91
Penn-Ohio Edison, 7% pf.	94	95½	97½
Penn-Ohio Elec., 7% pf.	93	93	96

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid, low, high, Tuesday, May 25. lBid, low, high, Wednesday, May 26. mLatest quotations available. n1925.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Saturday May 22	Low 1926	High 1926
STOCKS—Continued			
Penn-Ohio Pwr. & Lt., 7% pf	95½	94	97
Penn-Ohio Pwr. & Lt., 8% pf	105	100	106
Penn Pwr. & Lt.—$7—no par	*l*106	103	106¼
Penn Pub. Serv., 7% pf	98	96	100
Penn Pub. Serv., 6% pf	85	85	90
Penn Wtr. & Pwr., com	140	150	165
Phila. Co., 6% pf.—50	50	47⅞	50½
Phila. Co., com.—50	*k* 73½	59¼	76¾
Phila. Elec., com.—25	*c* 45⅞	41¼	67¼
Pittsburgh Utilities, pf.—10	*k* 20½	14½	20½
Portland Elec. Pwr., 7% pf	97	97	98
Portland Elec. Pwr., 6% pf	75	71	75½
Portland Elec. Pwr., 6% 2d pf	71	71	75
Portland Elec. Pwr., com	*k* 36	....	....
Potomac Elec. Pwr., pf	*j*106	....	....
Pwr. Corp. of N.Y., com—no par	*m* 79	77½	90¼
Pwr. Sec., pf.—no par	*k* 15	....	....
Pwr. Sec., com.—no par	*k* 6	....	....
Pub. Serv. of N. J., 7% pf	106	103¼	108½
Pub. Serv. of N. J., 8% pf	120½	115	120½
Pub. Serv. of N. J., com.—no par	*k* 80	72	92¼
Pub. Serv. of No. Ill., 6% pf	*a*101	100½	103
Public Serv. of No. Ill., 7% pf	*a*114	112	116¼
Pub. Serv. of No. Ill., com.—no par	*a*130	128½	137
Pub. Serv. of No. Ill., com	*a*130	128½	131½
Pub. Serv. of Okla., 7% pf	95	92	95
Pub. Serv. Elec. & Gas, 6% pf	100½	97	101¼
Public Service Elec. Pwr., pf	110¼	106	110
Puget Sound Pwr. & Lt., 7% pf	*k*104	....	....
Puget Sound Pwr. & Lt., 6% pf	*k* 83	....	....
Puget Sound Pwr. & Lt., com	*k* 43⅞	42½	66½
Radio Corp. of Am., pf.—50	*k* 47½	44¼	47¼
Radio Corp. of Amer., com.—no par	*k* 45½	32	46¼
Republic Ry. & Lt., pf	*k*104	....	....
Republic Ry. & Lt., com	*k* 84	....	....
Rochester Gas & Elec., 5% pf	95	80	98
Rochester Gas & Elec., 6% pf	98	100	102
Rochester Gas & Elec., 7% pf	105	105	107
San Joaquin Lt. & Pwr., 7% pf	97	97½	98½
St. Joseph Ry., Lt., Ht. & Pwr., pf	65	60	65
Servel Corp., Class A	*k* 23½	15½	30½
Servel Corp., Class B—no par	*k* 40	....	....
Sierra Pacific Elec., com	*k* 27	23	28½
Sioux City Gas & Elec., 7% pf	97½	96	98
S. E. Pwr. & Lt., pf —$7—no par	98½	97	100
Southeastern Pwr. & Lt., ptc. pf	62	60	67½
S. E. Pwr. & Lt., com.—no par	*k* 29½	20	46¼
So. Calif. Edison, 8% pf	130	135	140
So. Calif. Edison, 7% pf	*k*110	....	....
So. Calif. Edison, 6% pf	*k* 98½	....	....
So. Calif. Edison, com	113	115	148
Southern Cities Utilities, 7% pf	*k* 85	....	....
Southern Cities Utilities, com	*k* 43	28	49
Southwestern Lt. & Pwr., A	*k* 55	....	....
Southwestern Lt. & Pwr., B	*k* 45	....	....
Southwestern Lt. & Pwr., $6 pf	*k* 81	....	....
Southwestern Pwr. & Lt., 7% pf	*k*100½	....	....
Springfield (Mo.) Ry. & Lt., 7% pf	95	....	....
Standard Gas & Elec., 8% pf	*k* 57	53¾	57½
Standard Gas & Elec., 7% pf	*k*100	....	....
Standard Gas & Elec., com —no par	*k* 53½	51	69
Standard Pwr. & Lt., 7% pf	*k* 91	....	....
Staten Island Edison, pf.—$6—no par	93	93	95
Superheater, com.—no par	*k*138	....	....
Syracuse Lighting, 7% pf	102	105	107
Syracuse Lighting, 8% pf	115	....	....
Syracuse Lighting, com	300	260	315
Tampa Elec., com	*m*275	270	315
Tampa Elec., com., new	*k* 50½	50½	67
Tenn. Elec. Pwr., 6% pf	*k* 85	....	....
Tenn. Elec. Pwr., 7% pf	*k*100	....	....
Terre Haute, Ind. & East Trac., pf	20	23	37
Terre Haute, Ind. & East. Trac., com	3	3	5
Tex. Pwr. & Lt., 7% pf	*l*104½	102	105
Tide Water Pwr., 8% pf	*k*101	....	....
Timken Roller Bearing, com—no par	*k* 49½	44½	56½
Toledo Edison, 8% pf	113	112	114
Toledo Edison, 7% pf	102	101	103
Toledo Edison, com	100	....	....
Tri-City Ry. & Lt., 6% pf	89	87½	89
United Gas & Elec., 6% pf	94	94	97
United Gas & Elec., com.—no par	*m*57	56	66
United Gas & Elec. (N.J.), 5% pf	68	70	75
United Gas Impr.—50	*c* 98½	84½	144½
United Lt. & Pwr., pf.—$4—no par	46	....	51
United L. & P. pf.—$6.50—no par	86	81	91
United Lt. & Pwr., com. A.—no par, new	14	12½	28
United Lt. & Pwr., com., B—no par	*m* 60	140	165
Utah Pwr. & Lt., 7% pf	*l*101½	99	103½
Utica Gas & Elec., 7% pf	104½	103	105
Utica Gas & Elec., com	200	....	....
Utilities Pwr., & Lt., 7% pf	*k* 93	....	....
Utilities Pwr. & Lt., com A	*m* 30½	28½	37
Utilities Pwr. & Lt., com. B—no par	14	14	18
Vermont Hydro - Elec., 7% pf	94	95	96
Virginia Elec. & Pwr., 7% pf	103	101	103½
Virginian Pwr., 7% pf	108	102	104
Virginian Pwr., com	70	....	....
Wagner Elec., pf	*b* 69	64½	85
Wagner Elec., com.—no par	*b* 21	20	34½
Washington Ry. & Elec., com	*j*180	....	....
Washington Ry. & Elec., pf	*j* 89½	....	....
Washington Wtr. Pwr., com	126	130	134
West Mo. Pwr., 7% pf	*k* 91	....	....
West Penn., 7% pf. temp. ctfs	*m*100	95½	101
West Penn, com	*m*125	118	130
West Penn Elec., pf	98	95½	100½
West Penn Elec., Class A	93½	88½	97
West Penn Pwr., pf	109	108	112
West Va. Lt., Ht. & Pwr., 7% pf	95	95	98
West Va. Utilities, 7% pf.—50	42	43	45
Western Pwr., 7% pf	*k* 93	....	....
Western States Gas & Elec., 7% pf	*k* 90	....	....
Western States Gas & Elec., com	*k* 17	....	....
Westinghouse El. & Mfg., com—50	*k* 66¼	65	79½
Weston Elec. Instrument, Class. A	*k* 29	27½	31½
Weston Elec. Instrument, com	*k* 15½	13½	19
Wheeling Elec., pf	90	91	93½
Wis. Pwr., Lt. & Ht., 7% pf	90	85	90
Worthington Pump, pf. A	70	70	80
Worthington Pump, pf. B	55	53	65
Worthingington Pump, com	*k* 25½	20¼	44¾
Yadkin River Pwr., 7% pf	*l*105	102	105
Yale & Towne, com.—25	*k* 66	60½	66½
BONDS			
Abitibi Pwr. & Paper	6s	1940 *k*101½	....
Adir. Elec. Pwr	5s	1962 *k*101	....
Adir. Pwr. & Lt	6s	1950 *k*106½	....
Adir. Pwr. & Lt	5s	1930 97½	97 99
Ala. Pwr	5s	1946 101	99 101
Ala. Pwr	5s	1951 98	97 99½
Ala. Pwr	6s	1951 *k*104½	104½ 105½
Ala. Trac., Lt. & Pwr	5s	1962 *m*111	112 124
Aluminum Co. of Amer	7s	1933 *k*106½	106½ 107½
Amer. Gas & Elec	5s	2007 93	92 93
Amer. Gas & Elec	6s	2014 *k*100½	98 100½
Amer. Pwr. & Lt	6s	2016 *k* 99½	96 99½
Amer. Pub. Serv	6s	1942 100½	98½ 100½
Amer. Wtr. Wks. & Elec	5s	1934 *k* 98	....
Amer. Wtr. Wks. & Elec	6s	1975 *k* 94½	92½ 94½
Anaconda Copper	6s	1929 102½	102½ 103½
Anaconda Copper	6s	1953 *k*103½	....
Anaconda Copper	7s	1938 *k*106	....
Appalachian Pwr	5s	1941 *k*100½	....
Appalachian Pwr	6s	2024 95½	93½ 95½
Appalachian Pwr	7s	1936 107	105 107½
Arizona Pwr	6s	1933 100½	99½ 101
Arizona Pwr	6s	1947 96½	95½ 97
Ark. Central Pwr	6s	1948 103	102 103½
Ark. Lt. & Pwr	6s	1945 *k*103½	....
Ark. Lt. & Pwr	6s	1954 *k*100½	....
Assoc. Gas & Elec	6s	1965 94½	92½ 95½
Assoc. Gas & Elec	6½s	1954 *k*102	....
Berlin City Elec	6½s	1928 *m* 99½	98 100
Berlin City Elec	6½s	1929 97½	97 98½
Binghamton Lt., Ht. & Pwr	5s	1946 *k* 99½	....
Birmingham Elec	6s	1954 103½	102½ 104
Birmingham Ry., L. & P	4½s	1954 92	88 92½
Broad River Power	5s	1954 90	91 92
Broad River Pwr	6½s	1934 100½	100 102
Brooklyn Edison	5s	1949 *k*105½	....
Brooklyn Edison	6s	1930 104½	103½ 106½
Buffalo Gen. Elec. Ist	5s	1939 102	101½ 102½
Buffalo G. E., 1st & Ref	5s	1939 101½	101½ 102½
Buffalo G. E.	5s	1956 103½	99½ 103½
Burlington Ry. & Lt	5s	1932 96½	96 97½
Butte Elec. & Pwr	5s	1951 *k*101	....
Calif. Elec. Gen	5s	1948 *k*101½	....
Calif. Gas & Elec	5s	1937 101½	100½ 102
Calumet Gas & Elec	5½s	1960 101½	97½ 101½
Canadian Lt. & Pwr	5s	1949 57	56 64
Canton Elec	5s	1937 100½	100 101
Carolina Pwr. & Lt	5s	1938 105	100½ 105
Carolina Pwr. & Lt	5s	1956 *k* 99½	97½ 99½
Carolina Pwr. & Lt	6s	1953 *m*104½	104½ 105½
Cedar Rap. Mfg. & Pwr	5s	1953 100½	99½ 101½
Central Ark. Ry. & Lt	5s	1928 99½	99 100½
Central Ga. Pwr	5s	1938 96½	95 97
Central Ill. Lt	5s	1943 *k*100½	....
Central Ill. Pub. Serv	5s	1952 94½	92 94½
Central Ill. Pub. Serv	5½s	1950 99	96 99½
Central Ill. Pub. Serv	6s	1944 100½	99 101½
Central Ind. Pwr	6s	1947 99½	98 99½
Central Ia. Pwr. & Lt	6s	1944 100	99½ 101
Central Maine Power	5s	1939 99½	98½ 100
Central N. Y. Gas & El	5s	1941 *k* 98	....
Central Pwr. & Lt	6s	1946 *m*101½	....
Central Pwr. & Lt	6½s	1952 *k*105½	....
Central States Elec	6s	1945 94½	91 98½
Chattanooga Ry. & Lt	5s	1956 89½	81 90
Cincinnati Gas & Elec	5s	1956 102½	102 103½
Cincinnati Gas & Elec	5½s	1961 105	102½ 105½
Cities Service	6s	1966 *k* 92½	91½ 94
Cities Service	7sB	1966 *k*189	178 189
Cities Service	7sC	1966 *m*129½	125½ 131
Cities Service	7sD	1966 *k*104½	101½ 104½
Cities Service	7sE	1966 *k*109½	109 109½
Cities Service Pwr. & Lt	6s	1944 *k* 95½	95 96
City L. & T., Sedalia, Mo	5s	1952 84½	83 85½
Cleveland Elec. Illum	5s	1939 103½	102½ 103½
Cleveland Elec. Illum	5s	1954 103½	102½ 104
Cleveland Elec. Illum	7s	1941 111	110 112
Colorado Pwr	5s	1953 98½	95½ 99
Columbia Gas & Elec	5s	1927 *k*100½	....
Columbia Ry., Gas & El	5s	1936 94	92½ 95
Columbus, Dela. & Marion Elec	5s	1937 86	83½ 86
Columbus, Dela. & Marion Elec	6s	1937 94½	93½ 96
Columbus Elec. & Pwr	6s	1947 *k*103	....
Columbus Ry., Pwr. & Lt	5s	1940 *k* 98½	....
Columbus Ry., Pwr. & Lt	6s	1941 *k*104	....
Commonwealth Edison	5s	1943 *a*104	100½ 104
Commonwealth Edison	5s	1953 102	99½ 102½
Commonwealth Edison	5s	1954 *k*102	....
Commonwealth Pwr	5s	1939 *k* 93	....
Commonwealth Pwr	6s	1972 *k* 97	....
Commonwealth Pwr	6s	1947 *k*104½	....
Community Pwr. & Lt	6s	1950 100	98 100½
Conn. Ry. & Ltg	4½s	1951 90½	90 92
Consol. Cities Lt., Pwr. & Trac	5s	1962 81½	80 82½
Consol. Elec	5s	1955 97½	98 99
Consol. Gas of N. Y	5½s	1945 *k*106	....
Con. Gas. Elec. Lt. & Pwr. of Balti	4½s	1935 *e* 98½	95½ 98½
Con. Gas. Elec. Lt. & Pwr. of Balti. (notes)	6s	1949 107	105½ 108
Con. Gas. Elec. Lt. & Pwr. of Balti	5s	1965 101½	100 101½
Con. Gas. Elec. Lt. & Pwr. of Balti. (notes)	5½s	1952 *m*105½	104½ 105½
Con. Gas. Elec. Lt. & Pwr. of Balti. (notes)	6½s	1951 *m*109½	109 109½
Consumers Elec. L. & P	5s	1936 *k* 98	....
Consumers Pwr	5s	1936 *k*101½	....
Consumers Pwr	5s	1952 *k*103	....
Consumers Pwr	5½s	1954 *k*104½	....
Continental Gas & Elec	5s	1927 *k*100	....
Continental Gas & Elec	6s	1947 *k*101½	....
Continental Gas & Elec	6½s	1964 *k* 99	....
Continental Gas & Elec	7s	1954 *k*106	....
Cumberland Cty. Pw.& Lt	5s	1942 97½	94 97½
Dallas Pwr. & Lt	6s	1949 104½	104 105
Dayton Ltg	5s	1937 100½	100 101
Dayton Pwr. & Lt	5s	1941 102½	100 103
Defiance Gas & Elec	5s	1942 98½	98 99
Denver Gas & Elec	5s	1949 99	98 100
Denver Gas & Elec. Lt	5s	1951 97½	94 97½
Des Moines Elec	5s	1938 101	99 101
Detroit Edison	5s	1933 102½	101 102½
Detroit Edison	5s	1940 104	100½ 104
Detroit Edison	5s	1949 *k*103½	....
Detroit Edison	5s	1955 *k*104	....
Detroit Edison	6s	1932 *m*124½	124½ 135
Detroit Edison	6s	1940 *k*108½	....
Detroit Edison	7s	1928 *m*131½	124½ 134
Detroit Edison	7s	1929 *m*131	124½ 131
Detroit Edison	7s	1930 127	124½ 138½
Dominion Pwr. & Trans	5s	1932 96	95 97
Driver-Harris	8s	1931 97½	95 98½
Dubuque Elec	6s	1942 102½	102 103½
Duke-Price Pwr	6s	1949 *m*107	102 106
Duke Price Pwr	6s	1966 *k*102½	100½ 102½
Duquesne Lt	6s	1949 106½	105½ 107
Duquesne Lt	5½s	1949 105½	105 106½
Durham Pub. Serv	7s	1949 100½	99 101½
East Penn. Elec	6s	1953 104½	105 106
East. N. J. Pwr	6s	1949 101½	99 101½
East Oregon Lt. & Pwr	6s	1929 100	100 101
East. Tex. Elec	5s	1942 *k* 97	....
Economy Lt. & Pwr	5s	1956 98½	99 100
Edison Elec. Illum. of Boston (notes)	4½s	1928 99½	99½ 100
Edison Elec. Illum. of Bklyn	4s	1939 94½	93 99½
Edison El. Illum. (N.Y.)	5s	1995 106½	103 108½
El Paso Elec	5s	1932 *m*102	....
El Paso Elec	5s	1950 98½	95 99½
El. Pwr. Corp. (Germany)	6½s	1950 87½	85½ 89½
Elec. Refrigeration	6s	1936 103	100½ 107
Elmira Wtr., Lt. & R.R	5s	1956 97	96 97½
Empire Dist. Elec	5s	1949 94	92 94½
Erie Ltg	5s	1967 99½	99 100½
Evansville G. & El. Lt	5s	1932 99	99 100
Federal Lt. & Trac	5s	1942 96½	92½ 97½
Federal Lt. & Trac	6s	1942 102½	100 104½
Federal Lt. & Trac	6s	1954 94	93 96
Florida Power & Light	5s	1954 95½	91½ 95½
Florida Publ. Service	6s	1955 97	97 99
Florida Public Service	6½s	1949 99½	99 103
Ft. Smith Lt. & Trac	5s	1936 *k* 77	....
Ft. Worth Pwr. & Lt	5s	1931 100½	99 100½
Galveston Elec	5s	1940 87	89 92
General Elec	3½s	1942 89½	87 90
Georgia Carolina Pwr	5s	1952 92½	86½ 92½
Ga. Lt., Pwr. & Rys	5s	1941 87½	86½ 92
Ga. Ry. & Elec	5s	1932 99½	98½ 100½
Ga. Ry. & Elec	5s	1949 95½	94½ 97
Ga. Ry. & Pwr	5s	1954 98	96 99
Ga. Ry. & Pwr	6s	1947 *k*104	....
Ga. Ry. & Pwr	7s	1941 *k*105	....
German Gen. Elec	6½s	1940 *k* 98½	94 99½
German Gen. Elec	7s	1945 98	95 98½
Great Cons. Elec. Pwr. (Japan)	6½	1950 *k* 85½	85 86
Great Cons. Elec. Pwr. (Japan)	7s	1944 *k* 92½	....
Great Falls Pwr	5s	1940 103½	101½ 104½
Great Northern Pwr	5s	1935 99½	98½ 100½
Great Western Pwr	5s	1946 *k*100	....
Great Western Pwr	5½s	1955 100	99 101
Great Western Pwr	6s	1949 102½	102 103½
Great Western Pwr	6s	1952 *k*103½	....
Hamburg Elec	7s	1935 *k* 95½	94 97½
Havana Elec. R., Lt. & P	5s	1954 95½	92½ 95
Holtwood Pwr	6s	1954 104½	100 104½
Houston Ltg. & Pwr	5s	1931 100	99 101
Houston Ltg. & Pwr	5s	1953 96½	90½ 95½
Houston Ltg. & Pwr	5½s	1954 100½	99½ 102½
Hydraulic Pwr	5s	1951 102	101½ 102
Hydraulic Pwr	5s	1950 102	101½ 103
Idaho Pwr	5s	1947 99	96 99½
Ill. Elec. Pwr	6s	1943 103½	102 103½
Ill. Pwr	5s	1933 *k* 96	....
Ill. Pwr	6s	1944 *k* 99	....
Ill. Pwr. & Lt	5½s	1954 98½	97½ 99
Ill. Pwr. & Lt	6s	1953 102½	100½ 102½
Ill. Pwr. & Lt	7s	1953 102½	102 103½
Ind. Elec	6s	1947 99	98 100
Ind. Gen. Serv	5s	1948 98½	96½ 94
Ind. Lighting	4s	1958 83½	82½ 88½
Indiana & Mich. Elec	5s	1955 98½	96 98½
Indiana & Mich. Elec	5s	1957 100	97½ 100½
Ind. Service	5s	1950 93½	91½ 94
Ind. Service	6s	2020 86	83 88½
Ingersoll-Rand	5s	1935 100	....
International Pwr. Sec	6½s	1955 *l* 90½	....
Interstate Elec	6s	1933 96	94 98½
Interstate Pwr	6s	1944 *k* 99	....
Interstate Pwr	7s	1934 *k*100½	....
Interstate Pub. Serv	6s	1948 99½	98 99½
Iowa Ry. & Lt	5s	1932 99	97½ 100
Iowa Southern Utilities	5½s	1950 94	94 96
Jersey Cent. Pwr. & Lt	5½s	1945 96	95 98
Kansas City Pwr. & Lt	5s	1952 *k*103½	....
Kansas Elec. Pwr	6s	1937 *k*101½	....
Kansas Elec. Pwr	6s	1943 102½	99½ 102½
Kansas Gas & Elec	6s	1952 105½	101½ 106
Kansas Gas & Elec	6s	2022 95	92½ 93½

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid, low, high. *l*Bid, low, high, Wednesday, May 26. *m*Latest quotations available. *n*1925. Tuesday, May 25.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies		Bid Price Saturday May 22	Low 1926	High 1926
BONDS (Continued)				
Kentucky Hydro Elec....	6s	1949	102	99½	102½
Kentucky Utilities.....	6s	1949	102½	99½	102½
Kings Cty. Elec. L. & P..	5s	1937	103½	102	103½
Kings Cty. Elec. L. & P..	6s	1997	123½	120½	123½
Kings County Ltg.....	5s	1954	100½	98½	100½
Kings County Ltg.....	6½s	1954	109	106	110
Knoxville Ry. & Lt.....	5s	1946	97½	95½	98
LACLEDE GAS LT.....	5s	1934	100½	100	101½
Laclede Gas Lt.....	5½s	1953	k104	....	....
Laurentian Pwr.....	6s	1936	100½	100	101
Laurentide Pwr.....	5s	1946	100½	100	102
Lehigh Pwr. Sec.*.....	6s	2026	95	93	95½
Lincoln Gas & Elec.....	5s	1941	94½	92½	94½
Long Island Ltg.....	5s	1936	100½	99	100½
Long Island Ltg.....	6s	1954	101½	99½	102
Long Island Ltg.....	6s	1948	107½	104½	108
Los Angeles Gas & Elec..	5s	1939	k101	....	....
Los Angeles Gas & Elec..	5½s	1943	102½	99	102½
Los Angeles Gas & Elec..	5½s	1947	k102½	....	....
Los Angeles Gas & Elec..	5½s	1949	102½	99	102½
Los Angeles Gas & Elec..	6s	1942	106½	102½	105½
Louisiana Pwr.....	6s	1944	101	98½	101½
Louisville Gas & Electric.	6s	1937	101	100	102
Louisville Gas & Elec....	5s	1952	100	97½	100½
Louisville Gas & Elec....	5½s	1954	104	102	104½
Lower Austrian Hydro El.	6½s	1944	83½	82½	87½
Luzerne Cty. Gas & El...	5s	1948	99½	97½	99½
Luzerne Cty. Gas & El...	7s	1944	105	103½	105½
Luzerne Cty. Gas & El...	6s	1954	104½	102	104
MADISON RIV. PWR..	5s	1935	100½	100	101
Manila Elec.....	7s	1942	114½	102	115½
Manila Elec. Ry. & Ltg..	5s	1953	97	89½	97
Manitoba Pwr. L.....	5½s	1951	k 97½	94½	98
Memphis Pwr. & Lt.....	5s	1948	99½	99	100½
Metropolitan Edison....	6s	1952	108½	104	108½
Metropolitan Edison....	5s	1953	100½	96½	101½
Metropolitan Pwr.....	6s	1953	105	102½	104½
Michigan Lt.....	5s	1946	k100	....	....
Michigan No. Pwr.....	5s	1941	99½	97	100
Milwaukee El. Ry. & Lt..	4½s	1931	98	97	99
Milwaukee El. Ry. & Lt..	5s	1951	99½	98½	100
Milwaukee El. Ry. & Lt..	5s	1961	k 96½	....	....
Milwaukee El. Ry. & Lt..	6s	1953	104½	100½	104½
Minn. Pwr. & Lt.....	5s	1955	97½	95½	97
Minn. Pwr. & Lt.....	6s	1950	105½	104	106
Miss. Power.....	5s	1955	93	92	94
Miss. River Pwr.....	5s	1951	100½	99	100½
Miss River Pwr.....	7s	1935	101½	102	103
Mo. Edison Elec.....	5s	1927	m100½	100½	100½
Mo. Pwr. & Lt.....	5½s	1955	97½	96	98½
Mobile Elec.....	5s	1946	k 98½	....	....
Monongahela W. Pa. Pub. Service.....	5½s	1953	96	95	97½
Montana Pwr.....	5s	1943	k101½	....	....
Montreal Lt., Ht. & Pwr.	4½s	1932	97½	97	98½
Montreal Lt., Ht. & Pwr.	5s	1933	99½	99½	101
Montreal Pub. Serv.....	5s	1942	94½	94	95½
Mountain States Pwr....	6s	1938	100	98½	101
Municipal Service.....	5s	1942	93	92½	93½
NASHVILLE RY. & LT.	5s	1953	98½	96½	98½
Nashville Ry. & Lt.....	5s	1958	92½	90½	93
Nassau Lt. & Pwr.....	5s	1927	99½	98½	100½
Nassau & Suffolk Ltg....	5s	1945	92½	89½	93
National Elec. Power....	6s	1965	102½	92½	94
National Pwr. & Lt.....	7s	1972	k102	....	....
National Pub. Serv.....	6½s	1955	95½	94½	97
Nebraska Pwr.....	5s	1949	101	99	101½
Nebraska Pwr.....	6s	2022	98½	94½	99
Nevada-Calif. Elec.....	6s	1946	k102	....	....
Nevada-Calif. Elec.....	6s	1950	131½	98½	101½
New Brunswick Pwr.....	5s	1937	84	81½	85½
New England Pwr.....	5s	1951	103½	100½	104½
New Jersey Pwr. & Lt....	5s	1936	99	96½	99
New Orleans Pub. Serv...	4½s	1935	89½	87	89½
New Orleans Pub.Serv.,A.	5s	1952	k 96	....	....
New Orleans Pub. Serv...	5s	1955	95½	90½	96½
New Orleans Pub. Serv...	6s	1949	93	90	92½
N.Y. & Queens El. L.&P..	5s	1930	100½	100½	103½
N.Y. & Westchester Ltg..	4s	2004	81½	79½	81½
N.Y. & Westchester Ltg..	5s	1954	98½	97½	98½
New York Edison.....	6½s	1941	k117½	....	....
New York Edison.....	5s	1944	k104½	....	....
N.Y. Gas & El. L., H.&P.	5s	1948	105½	104	105½
N.Y. Gas & El. L., H.&P.	4s	1949	91½	89½	91½
N.Y. State Gas & Elec...	5½s	1962	101	100	101
Newport News & Hampton Ry., Gas & Elec...	5s	1944	90	89½	91
Niagara Falls Pwr.....	5s	1932	102	100½	103
Niagara Falls Pwr.....	6s	1932	105	104½	106½
Niagara Falls Pwr.....	6s	1950	106½	105	107
Niagara, Lock. & Ont. Pwr.	5s	1955	k101	....	....
Niagara, Lock. & Ont. Pwr.	6s	1958	m106	....	....
Norfolk Ry. & Lt.....	5s	1949	95½	94	96½
No. Amer. Edison.....	6s	1952	104½	101½	105
No. Amer. Edison.....	6½s	1948	k105½	....	....
No. Amer. Lt. & Pwr.....	7s	1954	98½	99	100½
North Caro. Pub. Serv...	5s	1934	k 96	....	....
North Caro. Pub. Serv...	6s	1954	96	94½	97
North Caro. Pub. Serv...	6½s	1944	99	98	100½
North Shore Elec.....	5s	1940	100½	98½	101
No. Calif. Pwr.....	5s	1948	100½	99½	101½
No. Ind. Gas & Elec....	5s	1929	99½	99	100
No. Ind. Gas & Elec....	6s	1952	104½	102½	105
Northern N. Y. Utilities..	5s	1955	98½	95	98½
Northern N. Y. Utilities..	5½s	1949	100½	100	101½
No. Ohio Pwr.....	7s	1935	k 92½	....	....
No. Ohio Trac. & Lt.....	4s	1933	90	87	91
No. Ohio Trac. & Lt.....	5s	1956	84	84	86
No. Ohio Trac. & Lt.....	6s	1937	99½	99	100
No. Ohio Trac. & Lt.....	6s	1947	95½	92½	96½
No. States Pwr.....	6½s	1933	110½	108	131
No. States Pwr. (notes)....	6½s	1933	103½	102½	104½
No. States Pwr.....	6s	1948	k105	....	....
No. States Pwr.....	6s	1941	k105	105½	106½
No. States Pwr.....	5s	1941	k100½	....	....
No. Tex. Elec.....	5s	1940	68	72	75
Northwestern Elec.....	6s	1935	102½	102	103½
Northwestern Pub. Serv..	6½s	1948	101½	99½	102½
Nova Scotia Tr. & Pwr...	5s	1946	88	88	90
OHIO PWR.....	5s	1952	98	94	98½
Ohio Pwr.....	6s	1953	105	103½	104½
Ohio Pwr.....	6s	2024	98½	95½	98½
Ohio Pwr.....	7s	1951	106	105½	106½
Ohio Pub. Serv.....	5s	1954	96½	92½	96½
Ohio Pub-Serv.....	6s	1953	103	101	102½
Ohio Pub. Serv.....	7½s	1946	113	112½	113½
Ohio Pub. Serv.....	7s	1947	112½	110½	112½
Ohio River Edison.....	6s	1948	104	101½	104½
Okla. Gas & Elec.....	5s	1950	94½	93	94½
Okla. Gas & Elec.....	6s	1940	k 96	....	....
Ontario Pwr. of Niagara Falls.....	5s	1943	k100	....	....
Ontario Transmission....	5s	1945	100½	99½	101
Ozark Pwr. & Wtr.....	5s	1952	84	77	84
PACIFIC COAST PWR..	5s	1940	99½	99	100½
Pacific Gas & Elec.....	5s	1942	k100½	....	....
Pacific Gas & Elec.....	5½s	1952	k104½	....	....
Pacific Gas & Elec.....	6s	1941	k108½	....	....
Pacific Lt. & Pwr.....	5s	1942	k101½	....	....
Pacific Lt. & Pwr.....	5s	1951	101	100	101½
Pacific Pwr. & Lt.....	5s	1930	k102½	....	....
Pacific Pwr. & Lt.....	5s	1953	m 96½	....	....
Parr Shoals Pwr.....	5s	1952	97	95	98½
Paterson & Passaic G.&E.	5s	1949	102½	100	101½
Penn Central Lt. & Pwr...	5½s	1975	96	94½	97
Penn Central Lt. & Pwr...	6s	1953	104	102½	105
Penn Edison.....	5s	1946	98½	96½	98½
Penn. Elec.....	6s	1955	m105	92	105
Penn Elec.....	6½s	1954	m105	97	100½
Penn.-Ohio Edison.....	6s	1950	102½	98	106
Penn Ohio Elec.....	6½s	1938	105½	105	107
Penn Ohio Pwr. & Lt.....	5½s	1954	100½	98½	100½
Penn Ohio Pwr. & Lt.....	6s	1939	98	97	98½
Penn Pwr. & Lt.....	5s	1952	99½	97½	99½
Penn Pwr. & Lt.....	5s	1953	99½	97½	99½
Penn Pwr. & Lt.....	6s	1953	105½	105	106
Penn Pwr. & Lt.....	7s	1951	106	105½	106½
Penn Pub. Serv.....	5s	1954	98	96	98½
Penn Pub. Serv.....	6s	1947	104½	103	105
Penn Wtr. & Pwr.....	5s	1940	102	101½	102½
Penn Wtr. & Pwr.....	5½s	1953	104	102½	103½
Phila. Co.....	6s	1944	k104½	....	....
Phila. Co.....	5½s	1938	k100½	....	....
Phila. Co.....	5s	1951	98½	97½	99½
Phila. Co.....	5s	1949	m104½	103½	104
Phila. Elec.....	5s	1966	c104	102	104½
Phila. Elec.....	4s	1966	c 88½	84	88½
Phila. Elec.....	5s	1960	c103½	102	103½
Phila. Elec.....	6s	1941	c108	107½	108½
Phila. Elec.....	5½s	1947	c107½	106½	107½
Phila. Elec.....	5½s	1953	c107½	103½	107½
Phila. Elec. Pwr.....	5½s	1972	c102½	100½	103
Portland Elec. Pwr.....	6s	1947	101½	99	102½
Portland Gen. Elec.....	5s	1935	100½	99½	102
Portland Ry., Lt. & Pwr..	5s	1942	k 92½	88½	94½
Portland Ry., Lt. & Pwr..	6s	1947	k100½	....	....
Portland Ry., Lt. & Pwr..	7½s	1946	106½	105½	108½
Potomac Edison.....	6s	1949	100	99	100½
Potomac Edison.....	6½s	1948	103½	103	104
Potomac Elec. Pwr.....	5s	1929	j100½	....	....
Potomac Elec. Pwr.....	5s	1936	j100½	....	....
Potomac Elec. Pwr.....	6s	1953	j106½	....	....
Potomac Elec. Pwr.....	7s	1941	j106½	....	....
Power Corp. of N. Y.....	6s	1942	101½	101	101½
Power Corp. of N. Y.....	6½s	1942	105	104	105½
Power Securities.....	6s	1949	k 79	....	....
Pub. Lt. & Pwr.....	5s	1945	67	68	73
Pub. Serv. Co. of Colo....	5½s	1954	96½	95	96½
Pub. Serv. Co. of Colo....	6s	1953	100½	100	101½
Pub. Serv. Co. of Colo....	7s	1933	101	101½	102½
Pub. Serv. Corp. of N.J..	5s	1959	m101	104½	105
Pub. Serv. Corp. of N.J..	6s	1944	k103½	....	....
Pub. Serv. Co. of No. Ill..	5s	1956	a 99½	97½	99½
Pub. Serv. Co. of No. Ill..	5½s	1962	104	103½	105
Pub. Serv. Co. of No. Ill..	5½s	1964	104½	103½	105½
Pub. Serv. Co. of Okla....	6s	1949	102	98½	102½
Pub. Serv. Elec. & Gas...	5½s	1959	105	103½	105½
Pub. Serv. Elec. & Gas...	5½s	1964	k105½	....	....
Pub. Util. Evansville, (Ind.)	6s	1929	k100½	....	....
Puget Sound Pwr.....	5s	1933	100½	99	101½
Puget Sound Pwr. & Lt...	5½s	1949	k101	....	....
QUEBEC PWR.....	6s	1953	103½	101½	104
Queensborough Gas & E..	5s	1952	100½	99½	100½
Queensborough Gas & E..	6s	1953	105	104	105½
Quincy (Ill.) Gas, Elec. and Heat.....	5s	1935	94½	93	94½
RHINE-WESTPHALIA ELECTRIC PWR.....	7s	1950	k 95½	93½	96
Rio de Janeiro Tram., Lt. & Pwr.....	5s	1935	94	93	94½
Robbins & Myers.....	7s	1952	60	58	68½
Rochester Gas & Elec....	5½s	1948	106	104½	106
Rochester Gas & Elec....	7s	1946	k111½	....	....
Rochester Ry. & Lt.....	5s	1954	101½	100½	101½
Rockford Elec.....	5s	1939	100½	99½	100½
Rome Wire.....	6s	1940	99	98	100½
ST. MAURICE PWR...	6½s	1953	108½	108	109½
St. Paul Gas Lt.....	5s	1944	101	100½	101
St. Paul Gas Lt.....	5½s	1954	101½	101	102½
St. Joseph Ry., Lt., H.&P.	5s	1937	94½	91½	97
Salt River Valley Wtr....	6s	1938	k100	....	....
Salmon River Pwr.....	5s	1952	100½	100½	101½
San Antonio Gas & Elec..	5s	1949	97½	96	97
San Antonio Pub. Serv...	6s	1952	105	101½	105
San Diego Cons. G.&.E....	5s	1939	k100½	....	....
San Diego Cons.G.&E....	6s	1939	102½	101	102½
San Joaquin Lt. & Pwr...	5s	1945	100½	98½	100
San Joaquin Lt. & Pwr...	6s	1950	104½	103	104½
San Joaquin Lt. & Pwr...	6s	1952	105	99½	104½
San Joaquin Lt. & Pwr...	6s	1954	103½	100½	103½
Sauda Falls.....	5s	1955	95½	94	96
Savannah Elec. & Pwr....	7½s	1941	k106½	....	....
Saxon Pub. Wks. (Germany).....	7s	1945	k 94½	....	....
Scranton Electric.....	5s	1937	102	101½	102½
Seattle Elec.....	5s	1930	100½	100½	101
Seattle Elec.....	5s	1929	99½	99	100½
Seattle Elec.....	5s	1939	93½	92½	94½
Seattle Ltg.....	5s	1949	93½	90½	94
Servel Corp.....	6s	1931	k102	99½	104½
Shawinigan Wtr. & Pwr..	5s	1934	100½	100	101
Shawinigan Wtr. & Pwr..	5½s	1950	104½	103½	105
Shawinigan Wtr. & Pwr..	6s	1950	104½	104½	105½
Sheboygan Elec.....	5s	1946	97½	94½	98
Siemens & Halske.....	7s	1928	k 98½	96	100
Siemens & Halske.....	7s	1935	k 97½	93	98
Sierra & San Fran. Pwr....	5s	1949	k 76½	....	....
Sierra & San Fran. Pwr....	6s	1949	k 90	....	....
Sioux City Gas & Elec....	6s	1947	102½	101½	103½
Sioux City Gas & Elec....	6s	1949	102½	102	103½
So. Caro. Gas & Elec.....	6s	1942	92½	78	97
So. Caro. Gas & Elec.....	6s	1932	80	70	82
Southeast Pwr. & Lt.....	6s	2025	k 94½	89	94½
So. Cal. Edison.....	5s	1939	k101	....	....
So. Cal. Edison.....	5s	1944	99½	98	99½
So. Cal. Edison.....	5½s	1944	104½	103	105
So. Cal. Edison.....	6s	1943	104½	102	104
So. Cal. Edison.....	6s	1944	k105½	....	....
So. Cities Utilities.....	8s	1931	m 99	99	102
Southern Colo. Power....	6s	1947	99½	97½	99½
So. Ind. Gas & Elec.....	6s	1947	k 99½	....	....
Southern Pwr.....	5s	1930	100½	100	101
So. Public Utilities.....	5s	1943	100½	100	101½
So. Sierras Pwr.....	6s	1936	k105	....	....
So. Wisconsin Pwr.....	5s	1938	92½	91	93
Southwestern Gas & E....	5s	1932	97½	97	98½
Southwestern Gas & E....	6s	1957	98	97½	99½
Southwestern Lt. & Pwr..	6s	1937	98	98	99½
Southwestern Power.....	6s	1944	96½	96½	98
Southwestern Pwr. & Lt..	5s	1943	96½	94	96½
Southwestern Pwr. & Lt..	6s	2022	95½	94	96½
Southwestern Pub. Serv...	6s	1945	94	94	96
Southwestern Utilities...	8s	1936	110	92½	96
Springfield Lt., Ht. & Pwr.	5s	1933	98½	99	100½
Standard Elec. of Cal....	5s	1939	100	99½	101
Standard Gas & Elec.....	6s	1935	k100½	....	....
Staten Island Edison.....	6½s	1953	106½	106	107½
Superior Water, Lt. & Pwr.	4s	1931	95	94½	95½
Syracuse Ltg.....	5s	1951	101½	100	101½
Syracuse Ltg.....	5½s	1954	104½	103½	104½
TAMPA ELEC.....	5s	1933	k 99	....	....
Tenn. Elec. Pwr.....	6s	1947	k105½	....	....
Tenn. Pwr.....	5s	1962	98	96	97
Tex. Pwr. & Lt.....	5s	1937	99½	98½	100
Tex. Pwr. & Lt.....	6s	2022	98½	95½	97
Tide Water Pwr.....	6s	1942	101	100	101½
Tide Water Pwr.....	7s	1937	104	100	107
Toho Elec. Pwr. (Japan)	7s	1955	k 92½	....	....
Tokyo Elec. (Japan).....	6s	1928	k 98½	....	....
Toledo Edison.....	5s	1947	100½	100	100½
Toledo Edison.....	7s	1941	k108½	....	....
Toledo Gas, Elec. & Htg.	5s	1935	100½	98	100½
Toledo Tr., L.&P. (notes)	5½s	1930	98½	98	99½
Topeka Edison.....	5s	1930	99	99	100
Topeka Ry & Lt.....	5s	1933	94½	94½	96½
Trenton Gas & Elec.....	5s	1949	102½	100½	102½
Tri-City Ry. & Lt.....	5s	1930	k 98½	....	....
Twin State Gas & Elec....	5s	1953	96½	95	96½
Twin State Gas & Elec....	5½s	1945	100	98	100½
Tyrol Hydro-Elec. Pwr....	7½s	1955	96	95½	97½
UJIGAWA ELEC PWR.	7s	1945	92	92	94
Union Elec. Lt. & Pwr....	5s	1932	101½	100½	102½
Union Elec. Lt. & Pwr....	5s	1933	101½	100½	101½
Union Elec. Lt. & Pwr....	5s	1954	100½	99½	101
Union Elec. Lt. & Pwr....	5½s	1954	100½	100½	102
United Elec. of N.J.....	4s	1949	88½	87	89
United Elec. Lt. & Pwr...	4½s	1929	98½	98	99½
United Lt. & Pwr. (notes)	5½s	1928	99½	99	100½
United Lt. & Pwr.....	5½s	1959	96½	96	97½
United Lt. & Pwr.....	6½s	1974	96½	95½	98½
United Lt. & Rys.....	5s	1932	k 96½	....	....
United Lt. & Rys.....	6s	1926	99½	100	101½
United Lt. & Rys.....	6s	1952	100½	99	101½
United Lt. & Rys.....	6s	1973	90	89½	92
United Pwr. & Lt.....	6s	1944	102	102	103½
United Water, G. & E....	5s	1941	95½	94	95
Utah Lt. & Trac.....	5s	1944	k 93	....	....
Utah Pwr. & Lt.....	5s	1944	k 98	....	....
Utah Pwr. & Lt.....	6s	1944	103	102½	104½
Utah Pwr. & Lt.....	6s	2022	95	88½	95
Utica Elec. Lt. & Pwr....	5s	1950	102½	100½	102
Utica Gas & Elec.....	5s	1957	101½	100½	102½
Utica Gas & Elec.....	5½s	1949	104½	103½	104½
VERMONT HYDRO - ELEC.....	6s	1929	100	100	101
Vicksburg Lt. & Trac....	5s	1932	95½	93½	95½
Virginian Pwr.....	5s	1942	100½	88	99
Virginian Pwr.....	6½s	1954	m108½	103	104½
Virginia Ry. & Pwr.....	5s	1943	99	97	99½
Virginia-Western Pwr....	6s	1953	105	101½	106½
WAGNER EL. MFG...	7s	....	m100½	100	101½
Washington Coast Util...	6s	1941	102½	102½	103½
Washington Ry. & Elec...	4s	1951	f 82½	....	....
Washington Ry. & Elec...	6s	1933	j103	....	....
Washington Wtr. Pwr....	5s	1939	102½	101½	102½
West Penn Pwr.....	5s	1963	102½	99½	102½
West Penn Pwr.....	5s	1946	102½	99½	102½
West Penn Pwr.....	5½s	1953	105½	104½	106
West Penn Pwr.....	7s	1946	105½	105	108½
W. Va. Lt., Ht. & Pwr...	6s	1929	101½	101	102½
West Virginia Utilities...	6s	1935	98½	95½	99
W. Va. Water & Elec....	6½s	1942	m103½	102½	104
Westchester Ltg.....	5s	1950	102½	102	103½
Western Elec.....	5s	1944	k102½	....	....
Western N. Y. Utilities...	5s	1946	98	96½	98
Western Pwr.....	6½s	1954	101½	100	102
Western Power Corporation	5s	1949	94½	94	95
Western Pub. Service....	6s	1950	98½	98	99½
West States Gas & Elec...	5s	1941	100	98½	100
West States G.&E. (notes)	6s	1937	94½	94	96
West States Gas & Elec...	6s	1947	k100	....	....
West United Gas & El....	5s	1950	102	101½	102½
Westphalia Un. Elec. Pwr	6½s	1950	k 84½	84	87½
Westinghouse El. & Mfg.	7s	1931	k105½	....	....
Wheeling Elec.....	5s	1941	99	99	100
Wichita R. R. & Lt.....	5s	1932	84½	83	88
Winnipeg Elec.....	6s	1954	96½	96	97
Wisconsin Elec. Pwr....	5s	1954	99½	98½	100
Wisconsin Gas & Elec....	5s	1952	k100½	....	....
Wis.-Minn. Lt. & Pwr....	5s	1944	k 97½	....	....
Wisconsin Pwr., Lt. & Ht	5s	1946	93½	92	94
Wisconsin Pub. Service...	6s	1952	101½	101	102½
Wis. Ry., Lt. & Pwr.....	5s	1933	95½	94	96
Wis. River Pwr.....	5s	1941	94	92½	94
Wolverine Pwr.....	7s	1943	102	100	101½
YADKIN RIVER PR..	5s	1941	k100½	....	....
Yarmouth Lt. & Pwr.....	5s	1937	84	83	87
Yarmouth Lt. & Pwr.....	8s	1951	102	99	102

Stock Exchange: oChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid, low, high, Tuesday, May 25. lBid, low, high, Wednesday, May 26. mLatest quotations available. n1925.

Manufacturing and Markets

Standardization of Screws

Wide Variety Used in Industry—Efficient Production Demands Study of Methods in Use

BY F. J. LOVETT
Sales Manager Metal Screw & Machine Company, Inc., Springfield, Mass.

IN OUR work of supplying various industrials with equipment for automatically driving screws in the fabrication of numerous products we have been impressed by the apparent lack of study given by many manufacturers to the selection of standard screws in making up their commodities. We have met this problem a number of times of late in the electrical industry. I do not wish to appear in any way to criticise electrical manufacturers for the existence of such an amazing variety of screws in their products, but would simply call their attention to the significance of present practice and to the advantages of looking more closely into the possibilities of standardization.

Our company manufactures and markets a machine for automatically applying screws to material in process, and in showing this equipment to electrical manufacturers we have found that the design of screw used has a controlling influence upon the ability of the manufacturer to utilize this labor-saving and time-saving method in his production. The increasing use of conveyor-type methods of routing parts through factories and of automatic and semi-automatic machinery justifies the careful study of many elements in the manufacturing problem formerly considered of trifling importance.

In the mechanical application of screws, especially where a hopper-type unit is employed to hold screws en masse for feeding to the work, the selectivity of the device for screw application is very important. It is most essential to present the screw point to the work every time, and we find that very small variations in the dimensions and weights of screws may mean all the difference between success and failure in the application of mechanical methods.

Unless the shank is heavier than the head, it is practically out of the question to secure the necessary 100 per cent correct feed on account of the tendency of the head to go to the bottom of the hopper before the shank. We have found that as small a difference in shank length as $\frac{1}{64}$ in. will turn the scale for or against mechanical screw driving, and the shape of the screw head and the distribution of material therein of course have a vital influence upon the behavior of the screw. The design of head—whether flat, dished or convex—should be considered in this connection, and intimately associated with this is the question of proper length. So far as pitch goes, standardization has made good progress, but the matter of screw balance needs to be more carefully analyzed.

The use of non-standard screws increases their cost tremendously, and I am inclined to believe that many engineers have specified particular screw lengths merely on the basis of using the minimum amount of material which will meet the conditions of mechanical strength demanded. This means cutting off many a screw in the design to save material, but in many cases it throws the screw into the special class. By using a standard screw—and in many cases this can be done without trouble from space limitations—the initial cost of the screw is lowered and the advantages of automatic or semi-automatic screw application can be enjoyed. Manual operations can be cut down and lower cost labor used in assembly, while the entire cycle of production is naturally speeded up in comparison with the maximum rate of screw application possible by hand methods.

Therefore it is recommended that electrical manufacturers study the possibility of utilizing standard screws more extensively in the production of flatirons, vacuum cleaners, switches, radio apparatus and many wiring devices, and that they examine the space available in the shells, frames and bases of their products and determine whether sufficient reasons exist to warrant the retention of present special-dimensioned screws or the adoption of designs which will permit the use of automatic or semi-automatic screw application machinery. Mechanical screw application can be done in from one-quarter to one-third the time of hand work, to speak conservatively, and the advantages of eliminating hand operations wherever this can be accomplished are too well known to need any argument at all.

The Price of Progress*

An Attitude of Mind to Examine a New Project on Its Merits, a Knowledge of Facts and the Willingness to Co-operate Are the Three Essentials of a Progressive Industry

BY ALFRED E. WALLER
President Electric Power Club

GREATER efficiency in the direction of our business affairs and turning the energy which has accomplished so much constructive work along technical lines into the large and fruitful field of commercial policies are the goal of the Electric Power Club. The principal subjects for discussion, the report of the committee on business policies, the subject of industry statistics and the proposed merger of the Electric Power Club and the Associated Manufacturers of Electrical Supplies represent efforts directed along different lines, but with this common object.

NEED FOR ACTION AND HARD WORK

The reasons why we have not attempted this work at an earlier date are well known and need not be reviewed. The important point is that we are moving in the right direction, and that the need for such action is thoroughly understood by all. There remains to be considered which things, of the many which are to be done, we shall undertake at this time. Following our decision in this matter will come hard work. We must not let our attention waver from the task in hand and must all support the work wholeheartedly. The public we serve today is interested only in results. We must be efficient to have the kind of results they want. If an automobile company, no matter how good its reputation, begins to turn out an inferior product, its business declines, and if the policy is not changed by those who are in power the company goes into the hands of a receiver and other people go into power who will change it. The same statement applies to any line of business. No matter whether a concern specializes in the manufacture of drugs, clothing, gas, electric power, advertising, testing, or personal service, if the organization is not productive of results it will not thrive and grow. Usually it will not survive very long, and we are interested only in the type of businesses which thrive and grow.

These statements are not made with the idea of airing time-honored truisms which have been folded in the camphor trunk long enough to acquire a temporary novelty. I want to quote from a half-page advertisement which appeared recently in one of our best known daily newspapers: "Business is 95 per cent honest," said a government official the other day. "The hue and cry against business which leads to more laws and more regulations is due not so much to illegal practices as to doubtful practices. Business must keep ahead of public criticism. It can no longer hide behind the old 'There are tricks in all trades,' and 'if business doesn't regulate itself, government will.'" It seems to me that this advertisement thoroughly typifies the spirit of today. I would like to suggest a variation of this statement which is attributed to a certain high government official, namely, that if those who are now in charge of business do not op-

*From an address given at Hot Springs, Va., May 24, 1926.

erate it at the maximum possible efficiency, somebody else, be it the government, or other private individuals, will certainly do it for them. For if it is not actually possible to take over a concern which is inefficient, it is usually possible for other concerns to take over its customers. To judge from the context of the remarks quoted in this advertisement, the government official in question was chiefly concerned that somebody should regulate a number of what he termed "doubtful practices" out of existence.

Wise planning calls for a much further and more important step than this. Efforts should be devoted, not to the regulation of what may be called doubtful practices, but toward the establishment of what are certainly sound practices. Business must keep ahead of public criticism. The coal business, both here and abroad, furnishes a striking verification of this statement. In each case an organized industry brought enormous pressure to bear upon the public, in the form of strikes and sympathetic strikes, but the background of economic and other facts was in each case such that it was impossible to keep ahead of public criticism and, therefore, the movement failed. When a tremendous drama of this kind has been enacted and something approximating the old order of business has been re-established it is not so difficult to look back and to understand what the public opinion was and what caused the movement to collapse. It is infinitely harder to obtain an accurate forecast of public opinion as it relates to some of the business problems with which we are confronted today. Certainly it is not a one-man undertaking, and for this reason we have such bodies as the Electric Power Club.

PLAN WISELY AND SUPPORT POLICIES

As the era of personal and independent action, the day of one-man companies and one-company policies pass, trade associations become increasingly important. In general there is lean picking today for the lone wolf, and the prospect, so far as he is concerned, is not improving. The only way to choose our policies wisely is to meet as we are meeting, to discuss them, sift out the unsuitable, determine upon a plan, and then give it enthusiastic support. Everything for which we have to be thankful has been gained by co-operative effort. The case for group action is impregnable.

If we are not satisfied with the results we have obtained from our trade associations in the past the fault is not with the underlying principle of co-operative effort; it is with the way in which we have used the associations or the objects we have sought to attain. We have wished for progress, but have not been willing to pay the price.

PRICE OF PROGRESS IS DEFINITE

What, then, is the price? Obviously, progress is not purchasable as such, but the price is perfectly definite and tangible and is payable in three installments. The first is an attitude of mind. We must be willing, when a new project is brought forward, to examine it on its merits. Is the fundamental idea sound? What effect will it have on our other activities and on those of other groups? Is it what should be done? Is the method correct? Can it be improved? If it is not correct, what else can be substituted for it and attain the same results? What suggestions are there? If the plan is acceptable, except for a certain item, what is that item? If the whole plan does not appeal, how far is it acceptable, and what modifications will make it satisfactory? All this sounds rather elementary, and yet it is a fact that in the last year from 15 to 30 per cent of the membership of the Electric Power Club has failed to respond to various communications, all in the regular order of business, even though these communications were followed by letters and telegrams urging action. Efficiency and progress do not lie in this direction. The "do not answer" group may at times be large enough to change the direction of a vote—things would be much simpler, and much more quickly and economically handled if their wishes could be known.

The wonderfully fine work done by the committees handling our three principal subjects has been handicapped by the apathy, or apparent apathy, of an appreciable fraction of our membership. As a result of much correspondence and many telegrams, Mr. Wolcott, chairman of the business policies committee, succeeded in getting returns from 67 of our 80 member companies to which his questionnaire was sent. He has built a splendid piece of work on this foundation. Enthusiastic support of 100 per cent would have made even greater things possible.

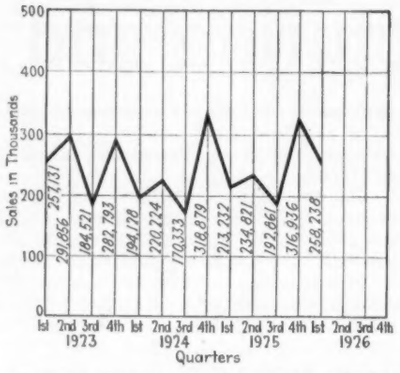
Let us consider industry statistics. Of our membership, 12½ per cent failed to acknowledge any communications on this subject, and 16¼ per cent additional acknowledged the letters and agreed to respond definitely at a later date, but they never did so. This makes a total of 28¾ per cent of our members who furnished neither inspiration nor practical assistance of any kind on this subject. It is unsatisfactory to formulate reports, action and recommendations upon such returns, and yet the work must be done. It has been done and well done, but there are many projects that might be of far-reaching benefit in the future which no one cares to undertake at this time, because the effort required for accomplishment is too great. These cases are typical and are not exaggerated instances. It cannot be too strongly emphasized that the dues which are paid to the Electric Power Club in cash represent the energy which is absorbed by the internal losses of any good motor. The club is a well-designed and reliable machine for putting our ideas into effect, but we must supply the ideas.

FACTS ARE NEEDED

The second requisite, if we are to make progress, is information. We must have facts. Therefore, we must be willing to doubt the things we have been calling facts and seek out the truth. Facts are like maps or telephone books. They are constantly changing, and that which was true ten years or five years, or even one year ago, may now be entirely untrue, or, what is much more dangerous, only partly true. Much has been said in the past year about facts and statistics and their use, but I wish to emphasize that the second installment toward the price of progress is a willingness to gather facts and to use them both as individuals and as members of this group.

The third and final installment is willingness to do those things which the facts indicate as right and proper, even if they upset age-old traditions. Methods which were effective at one time may not be adequate now. I shall not attempt in any way to touch upon the multitude of applications which these statements have in individual concerns. The very structure of our association organizations has shown itself to be inadequate, and later at this convention we are to consider a proposed merger with the Associated Manufacturers of Electrical Supplies. In association work many time-honored customs and methods have become obsolete. Many of our processes of standardization and other activities need careful study and thought, as they are becoming, if they have not already become, so cumbersome as to be practically unworkable. Some of

Vacuum Cleaner Sales



Vacuum-cleaner sales by quarters during 1923, 1924 and 1925 and the first quarter of 1926. (Data supplied by Vacuum Cleaner Manufacturers' Association.)

Electric Industrial Trucks and Tractors

The number of electric industrial trucks and tractors shipped during April, 1926, by the nine leading manufacturers in the industry has been announced by the Department of Commerce. The table also shows the figures by quarters since the beginning of 1925 and by months from January, 1926.

SHIPMENTS OF ELECTRIC INDUSTRIAL TRUCKS AND TRACTORS

	Domestic		
1925	Tractors	All Other Types	Exports
Quarter ended:			
March 31	*45	*259	41
June 30	49	*280	50
Sept. 30	*57	*286	12
Dec. 31	*41	*295	*25
Total	*192	*1,120	*128
1926			
Quarter ended Mar. 31	*47	*310	*17
January	*21	86	*4
February	15	*96	5
March	11	*128	8
April	17	90	4

* Revised.

the most substantial accomplishments of which we have any record have been brought about by choosing a small group of men who are tried and true and giving them power and support. More faith in our associates will multiply our ability to progress. In standardizing, we will have to spend less time discussing points upon which we do not agree and more time writing down the many things upon which we do agree, and getting those items which are acceptable into circulation. Technical standards and business policies should be evolved by the best men we can get, but if these men must always spend much of their time discussing unessential and unimportant details, the cost of doing the work will be disproportionately high, and much that is necessary will never be undertaken. Bearing in mind the warning which Mr. Spillman gave us last year, that we must not confuse a vacancy with an open mind, we shall achieve our progress by means of these three things: An open mind, facts and the application of facts.

Business Conditions

IN THE reports of business conditions this week there are to be found no greatly outstanding transactions which could be considered as indicative of feverish activity anywhere in the country. There is, instead, the much more desirable economic condition of buyers taking what their current needs require and sellers of electrical goods maintaining a firm market and giving no evidence of any tendency to cut prices. That is to say, the present easy and unhurried market can be almost termed normal, if one may imagine a business norm.

New England and the New York district present the least optimistic reports. These report sales of central-station equipment to be below normal and the former says that industrial equipment orders have slumped. But even in these districts the bread is not entirely butterless; projected constructions will soon put buyers in the market again, and the volume of sales of material and small devices indicates that the ultimate consumer still has money in his pocket.

The industrial awakening of the New South is evidently proceeding satisfactorily if one judges from the report presented here. Central stations placed orders for more than $200,000 worth of miscellaneous equipment, and construction of railway and industrial projects has kept the pot boiling quite vigorously. The North and South Central States appear this week to occupy a position on the business scale comparable to their geographic location; they are about in the middle. There have been no transactions of special interest, but every one appears to be happy. On the Pacific Coast a lack of rainfall in the Hawaiian Islands made itself felt in rather larger orders for irrigation pumping equipment, as did the same condition in the Island Empire in the Northwest. Railroad electrification and building constructions made large demands for line equipment and supplies as well as lighting units and wiring material.

In conversation with manufacturers and their agents attending the Electric Power Club convention at Hot Springs, Va., this week the ELECTRICAL WORLD representative learned that business, while it was a little slow at the present moment, was not stagnant and that each manufacturer was sure that his partciular line was happily facing a period of non-spectacular but very satisfying activity.

Lead Bright Spot in Metal Markets —Copper Selling Dull

Except for a brisk business in lead following the reduction in price to 7.65 cents New York last Friday, the week was a dull one for non-ferrous metals. Volume of copper sales was particularly small. Holidays in London, with the consequent absence of cable quotations, probably contributed to the lethargy, but domestic buyers were not much in evidence. Zinc was steady, with nearly average business, and tin and silver were quiet. Antimony broke to 9.50 cents, duty paid New York.

Though there was little quotable change in the price, copper seemed easier than a week ago. The only business reported on Wednesday was at 13.80 cents delivered, but sales were conspicuously few after Monday and it is likely that some metal could be obtained at a concession from this price. The buying is mostly for June and several sales were made for immediate shipment. Virtually all of the moderate business in zinc was done at 6.85 cents St. Louis, though one sale was made at 6.80 cents and two small lots went for 6.825 cents.

Though London prices advanced a week ago Friday, the American Smelting & Refining Company cut its contract price for New York lead on that day from 7.75 cents to 7.65 cents. The reduction brought the New York price below the lowest level reached last year, which was on April 21 and 22, when the market was quoted at from 7.65 cents to 7.75 cents., and after which it steadily rose. Buying has been much better since the reduction was made, both of the two principal sellers reporting an excellent business, chiefly for June shipment. Slight improvement in demand is noted from battery and white-lead manufacturers. Consumers did little in the tin market in the last week, but there was a moderate amount of trading among dealers.

NEW YORK METAL MARKET PRICES

	May 19, 1926 Cents per Pound	May 26, 1926 Cents per Pound
Copper, electrolytic	13¾	13.8
Lead, Am. S. & R. price	7¾	7.65
Antimony	12¾	12.25
Nickel, ingot	35	35
Zinc, spot	7.225	7.225
Tin, Straits	61¼	61
Aluminum, 99 per cent	28	28

Base copper price May 26, 1926, 16 cents

Small Motors, Control Equipment Active in New York District

Industrial buying of small motors and control equipment continues active, manufacturers almost unanimously reporting an improvement in conditions over last month. One manufacturer reports a sudden demand for fans last last week, but this did not continue long when the cool weather returned. Sales of the larger-size equipments for industrial purposes are considerably below normal. Central-station buying has been rather spotty, the demand for poles, cross-arms and line hardware showing a considerable falling off. Transformer sales are steady and in fair volume, although no individual orders are of outstanding magnitude. Buying of switching equipment shows an improvement, a manufacturer reporting one order for $45,000 and another for $6,000 worth of apparatus, with a fair volume of smaller orders.

General Business Volume Is Up in St. Louis District

During the past week there has been very little business of special interest moving in the St. Louis district. No very large orders in any branch of the industry have been reported. However, manufacturers and jobbers state that the general volume of all lines averages as good as or better than in the previous week. Diesel-engine builders have some large engines on the floor for installation in central stations in this district. They report business very good—much better than last year—specifications calling for larger engines, most of them over 1,000 hp. Prospects seem good for a continuance of the business throughout the year. Builders of disconnecting switches for line service say that their business is 40 per cent ahead of last year, with bright prospects for the remainder of 1926.

High-tension transmission lines are being extended south from St. Louis into the Ozark foothills. Large deposits of first-class building and road gravel are found in that region, and quantities have been shipped to St. Louis. To date all of the dredging plants have been steam-operated, but now specifications are being prepared for the complete electrification of three of the largest of these plants.

Middle West Business Is Quiet, but Firmness Is Maintained

Business in the Middle West continues on a quiet, easy basis. The volume of business is holding up well, and although there is no great activity in some lines of business, generally the situation is satisfactory and the outlook is optimistic. The number employed in factories decreased about 1 per cent, which is considered normal. Numbers of carriers are coming into the market with purchases of rolling stock and equipment. The various utility companies are busy with construction work, a great deal of underground work being in progress. In evidence of this one large utility company placed an order this week for

1,000,000 ft. of stone conduit. There has been a good demand for apparatus this week, the following items being bought: Two feed-water heaters, one four-stage centrifugal boiler-feed pump, a quantity of truck-mounted oil circuit breakers valued at $40,000, a quantity of steel-inclosed outdoor-type isolated-phase circuit breakers valued at $140,000, a quantity of steel-inclosed, isolated-phase, 600-amp., 15,000-volt truck-type switch units valued at $25,000, and three 5,000-kva. transformers.

Jobbers' sales were considered normal, with a slight decrease in the volume of business. Unsettled weather conditions have retarded fan sales somewhat, although the season has not fairly begun as yet. Washing-machine and vacuum-cleaner sales are holding up well.

Industrial Activity Boosts Equipment Sales in Southeast

Very satisfactory trade in practically all lines of electrical business is being sustained, with an increased activity in the textile field to be noted. Several large electrification jobs have been let recently, and an order was received from a textile plant last week for $8,000 worth of wiring supplies. Other large orders of a similar nature are in immediate prospect. Safety switches are moving well, with a satisfactory demand for industrial switches also reported. Orders in Atlanta for inside construction materials took quite a jump last week on account of the letting of wiring jobs on the Sears, Roebuck & Company plant and several other large construction projects in that city.

Central-station activities continue to play an important part, one manufacturer reporting the receipt last week of one order for water-power generators and accessories amounting to approximately $100,000 and switching equipment orders from a Florida power company aggregating $75,000. Other outstanding single orders from central stations during the past week or so consist of $40,000 worth of switchboards and equipment and 71 miles of No. 4/0 copper strand. High-tension transformer equipment is only normal, though prospects are for considerably increased activity in this line as industrial plants under construction get further along.

Considerable large industrial activity is in the air, the Atlanta, Birmingham & Atlantic Railway having announced proposed additions and improvements to its Brunswick (Ga.) terminals, the expenditure to approximate $250,000, and the Interstate Commerce Commission having announced the proposed construction by the St. Louis-San Francisco Railway of a 152-mile line between Aberdeen, Miss., and Kimbrough, Ala.

Hawaiian Orders Raise Business Volume on Pacific Coast

On the Pacific Coast business appears to be maintaining itself in pretty fair shape. There have been no spectacular orders, but the average run of the mill might be termed a little more than satisfactory. The ill wind that blew rain clouds away from the Hawaiian Islands swelled coast machinery demands with about $100,000 worth of pumping equipment orders, consisting of 20 motors from 10 hp. to 40 hp., 70 transformers up to 50 kva. in size and switchboard and wiring supplies. The ill wind should really share the honor for these orders with the intensive selling efforts made by the venders. Other orders include transformers and equipment complete for a 750-kw. automatic railroad substation. Evidence of the spread of domestic heating by oil is given by an order for 400 motors in ½-hp. and ¼-hp. sizes. Power-company buying in the past week has included a fifty-thousand-dollar cross-arm contract, 55-ft. and 60-ft. poles to the value of $7,000, a carload of four-duct underground tile and miscellaneous lots of material in orders of from $1,000 to $5,000. Railroads took a ton of friction tape, 7,500 galvanized steel pins and much assorted construction material. Two hospitals, one in Oakland and the other in Los Angeles, each required about 1,500 lighting units. Show-window lighting is going forward briskly. Contractors' business is rather quiet but orders for 100-200-amp. switches and 75,000 ft. of lamp cord might be taken to indicate that a little spurt is coming. A transformer manufacturer reports substation transformer orders totaling 16,000 kva. in comparatively large units at 11,000/2,000 volts.

Advices from Seattle indicate that the situation in the Northwest is much the same as on the rest of the Pacific Coast. The Great Northern Railway is proceeding with its electrification program, and its orders for 600 suspension-type insulators and a carload of assorted pole-line hardware gave a brisk tone to this phase of the supply business, which might otherwise have appeared sluggish on account of power companies taking their supplies in April or earlier for summer construction. The Yakima country and Methow Valley took 22 irrigation pumping outfits equipped with large electric motors, while the lumber industry got itself a 150-hp. blower motor and two pulp and paper projects made inquiries for motors for their plants now in construction. Several Seattle jobbers report large orders for electric ranges for installation in apartment houses.

Sales in New England District Are Marking Time

A marked recoil in sales appears to have prevailed throughout New England during the past week, and with the exception of a fairly steady demand for small motors and encouraging prospects for a number of deliveries of transformers, the tone of buying of electrical equipment is in sharp contrast with the favorable trend of recent weeks.

Industrial equipment orders have slumped; delays in placing several interesting orders are reported, and negotiations appear to have been curtailed for the time being, though a few inquiries for exceptionally large units to be erected in the near future have been made. Of these, two queries for three large turbo-generators of exceptionally high ratings and amounting to about $3,000,000 are of striking interest.

Central-station supplies are moving unevenly. One prominent manufacturer reports a good many small-lot orders for replacement material, including small switches, wire, hardware accessories and line supplies. Another manufacturer reports an encouraging trend in meter sales and records a volume to date for the current year well above that for a corresponding period in 1925, with central Massachusetts very active in demand. New construction supplies, on the other hand, have not been as active in demand as for the same period of 1925, and sales of armored cable, wire and house-wiring devices have lagged. In spite of this lull, however, the amount of construction begun and projected dispels every chance of a dull seasonal output. Much construction has been late in getting under way, but, now started, will soon result in good demands all along the line.

Household appliance sales are spotty. Washers are selling well and electrical refrigeration is popular. Many jobbers report less buying at this time than in previous years; on the other hand, one group of central stations records a striking flurry in sales of household appliances during the week ended May 15.

Activities of the Trade

Westinghouse Company Extends Factory and Office Facilities

The present building projects, in construction or planned, of the Westinghouse Electric & Manufacturing Company will require the expenditure of $5,525,000, according to T. P. Gaylord, acting vice-president. Items in the building program include: General office building at East Pittsburgh works, eleven floors, floor area 165,000 sq.ft., to accommodate 18,000 employees, cost $1,500,000; finished-product warehouse at Mansfield, Ohio, four floors, 130,000 sq.ft. floor area, cost $500,000; office, warehouse and service station in one building at Detroit, floor area 100,000 sq.ft., four stories, cost $400,000; factory building for cement-pole plant of George Cutter division at St. Louis, one floor, 38,000 sq.ft. area, cost $300,000; additional buildings at East Springfield (Mass.) works, cost about $750,000; four-story extension to main factory building at East Pittsburgh, cost with other improvements about $200,000; factory buildings at Sharon, Pa., and an office building at Derry, Pa., cost about $350,000.

N. E. L. A. Exhibition Committee Elects Three New Members

A large number of exhibitors of the class D (manufacturing) members of the National Electric Light Association met at a meeting held in Atlantic City, N. J., last week during the convention, under the direction of C. L. Peirce, Jr.,

chairman. Three members were elected to the exhibition committee for a period of three years, as follows: J. C. McQuiston, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.; George A. Hughes, Edison Electric Appliance Company, Chicago, and E. D. Doty, Delco-Light Company, Dayton, Ohio.

Riley Stoker Corporation Elects New Officers

Fred H. Daniels, general manager of the Riley Stoker Corporation, has been elected president to fill the vacancy resulting from the death of R. Sanford Riley; Aldus C. Higgins, vice-president, has been elected chairman of the board of directors, and James W. Armour, engineering manager, has been elected a member of the board of directors. The officers of the company are now as follows: President, Fred H. Daniels, Worcester, Mass.; vice-presidents, Aldus C. Higgins, Worcester, Mass.; William Pestell, Worcester, Mass.; R. T. Riley, Winnipeg, Manitoba; S. A. Armstrong, Toronto, Ontario, and secretary and treasurer, David K. Beach, Worcester, Mass. The board of directors of the company now consists of Fred H. Daniels, Aldus C. Higgins, William Pestell, David K. Beach, George N. Jeppson, Charles L. Allen, Henry S. Pickands, and James W. Armour.

Since the organization of the company in 1911 Mr. Daniels has been closely associated with Mr. Riley in connection with the affairs of the company, having served respectively as secretary, general manager and vice-president. The company announces that the same policies and principles which have resulted in the company's growth under the leadership of Mr. Riley will be continued in the carrying on of the business.

The General Electric Company has awarded a contract for the immediate construction of a factory addition to its Buffalo plant. The building will be of the one-story type, 122 ft. x 184 ft.

The Austin - Henderson Company, Spokane, Wash., sales agent for electrical machinery, has moved its office and salesroom to 118 Lincoln Street, where greatly enlarged quarters are provided.

The Syracuse Washing Machine Corporation, Syracuse, N. Y., announces that it has placed on the market a new "Easy" washer which is said to be a different combination of a washing and drying machine, the washing and drying units being individual but combined in a single apparatus. The washer is also equipped with a complete water-circulating system. The company states that, in addition, its present model will be continued. Coincident with this announcement, the company further says that it is ready to ship the new washers to all its dealers.

The Instant Electric Water Heater Company, 304 East Washington Avenue, Bridgeport, Conn., announces that it has closed a contract for approximately 200 instantaneous electric water heaters for equipping a new development at Wayside Village, Eagle Lake, Fla.

The Electric Refrigeration Corporation, Buhl Building, Detroit, announces that it is now marketing a new line of eight cabinet Kelvinator models. The units are housed in flush-panel hardwood Leonard cabinets finished either in white enamel pyroxlin or in golden oak. The interior finish is white enamel on galvanized iron.

The Fibroc Insulation Company, Valparaiso, Ind., announces that patents have been granted on a new self-lubricating bakelite silent gear material, known as Fibroc-GR. Gears of this material are said to assure perfect lubrication at all times as well as 35 per cent longer life.

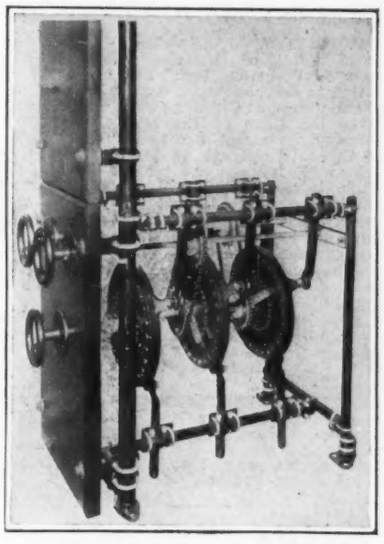
The Coldak Corporation, 8 West Fortieth Street, New York, manufacturer of Coldak electric refrigerators, announces that Thomas E. Spence, formerly vice-president and sales manager of the Electrolux Company, has been appointed general sales manager.

The Tafel Electric Company, 329 West Main Street, Louisville, jobber, announces that a branch house has been established at 616 Broad Street, Chattanooga, Tenn. The building contains 22,000 sq.ft. and will serve all of Tennessee east of Nashville and parts of Virginia, Georgia and Alabama. Sidney Steinau will have charge of this new branch house.

New Equipment Available

Switchboard Wiring Devices

Several new types of supports and arrangements of switchboard accessories have been developed by the General Electric Company. A complete standard line of indoor bus and cable supports for light, moderate, heavy and extra-heavy duty is now available for flat surface mounting. The company has also developed a new arrangement of support for group-mounted rheostats, shown in the illustration, using pipe and standard pipe fittings. Where inclosed potential buses are desired a conduit with a slip joint is being used. This arrangement makes use of conduit of different sizes, where the smaller conduit slips within the larger and is fastened to the condulet by means of a bushing and locknut. Square steel rods and adjustable supports are also being used by the company for transformer banks where insulated wire is mounted on porcelain cleats.



MECHANISMS AND SUPPORTS FOR THREE GROUP-MOUNTED RHEOSTATS

Shovel-Type Transformer

A new shovel-type transformer has been placed on the market by the Westinghouse Electric & Manufacturing Company, the outstanding characteristics of which are a heavy end frame construction, a welded sheet-metal tank and additional bracing to prevent the transformer from sliding around inside the tank. This transformer is especially useful in applications that require a unit having oil-tight tank and bushings. A specific application is that of electrically operated shovels. These transformers are manufactured at present for 2,300-volt, single-phase, 60-cycle service, but it is also possible to obtain them in other voltages.

Flexible Couplings

A flexible coupling that can be universally applied to any direct-connected load from a fractional-horsepower motor drive to the operation of large rolling mills has been developed by the Clark Controller Company, Cleveland. For a given shaft diameter this coupling is said to have a comparatively small outside diameter, and it provides ample compensation for angular or parallel misalignment with allowance for end float without excess pressure on either the driving or driven apparatus. The coupling is noiseless in operation, no bolts or screws are used, and no grease or oil is necessary. It has few parts and may be disassembled conveniently. When assembled, it presents a smooth surface similar to an ordinary pulley.

The driving hub and sleeve each contain four projecting teeth. When the hub rotates the four projecting teeth press against four pieces of packing. This pressure is transmitted to the four inwardly projecting teeth on the sleeve. These teeth extend across to the other hub and transmit to the other four pieces of packing the pressure on the teeth on the driven hub. The packing is in compression and all shear strain is taken by the heavy steel section. A keeper ring and a spring retaining ring make up the assembly.

Electric Melting Pots.—The line of Trent melting pots manufactured by Harold E. Trent, 259 North Lawrence Street, Philadelphia, has been extended to include a 45-lb. pot controlled by a three-heat switch and having separable plug connection. This pot is adapted not only for ladle and dipping work, but also for pouring, as a spout and handle are part of the standard design. It is particularly useful where solder, babbitt, tin or lead is melted.

New Trade Literature

COUPLINGS. — The Clark Controller Company, Cleveland, is distributing bulletin No. 103, covering the Clark flexible couplings for operating in connection with motors driving reversing mill tables, pumps, compressors, cupola, blowers, screwdowns, etc.

CABLE BOXES.—Ferranti, Ltd., Hollinwood, Lancashire, England, is distributing pamphlets Ta 170 to 170/13 covering the various types of the Ferranti patent oil and compound-filled cable boxes. Dimension tables and price lists are included.

THEATER LIGHTING. — "Illumination Control for the Modern Theater" is the title of a booklet issued by the Cutler-Hammer Manufacturing Company, Milwaukee, in which it describes the use of the "C-H" dimmers in connection with illuminating the modern theater. It contains numerous illustrations showing typical installations of the "C-H" dimmers and switchboard arrangements for the remote control of same. Charts showing comparison of resistance and reactance type dimmers are included. Attention is also called to the advantage of remote control and preselection through "C-H" magnetic switches.

FUSE AND DISCONNECTING SWITCHES.—Bulletin No. 1 issued by the W. N. Matthews Corporation, 3702 Forest Park Boulevard, St. Louis, covers the various types of Matthews "Fuswitches" and disconnecting switches. A review from the time "Fuswitches" were introduced to electric light and power companies in 1908 up to the present-day switch is given in this booklet. Safety factor, rupturing capacity, flashover, construction and other features are described in the booklet. Several illustrations showing typical installations are included.

CENTRIFUGAL PUMPS FOR IRRIGATION PURPOSES.—"De Laval Pumps in Profitable Irrigation Plants" is the title of a booklet issued by the De Laval Steam Turbine Company, Trenton, N. J., which describes and illustrates numerous orchards and farms irrigated by pumping in the fruit-raising section of Oregon, including the Grant's Pass district, where water is pumped for nearly 20,000 acres. Data on the selection of pumps to suit individual requirements, pump characteristics, pipe friction, speed and horsepower calculations, etc., are included.

ELECTRIC SPECIALTIES.—Catalog No. 26 issued by the G. & W. Electric Specialty Company, 7776-84 Dante Avenue, Chicago, fully illustrates and describes the G. & W. Electric specialties, including potheads, boxes, cable terminal devices, distribution specialties, etc. It also contains instructions for installing potheads and underground cable boxes and other useful information.

CENTRIFUGAL PUMPS.—Bulletin No. 30 issued by the Taber Pump Company, Buffalo, describes and illustrates the various types of the Taber centrifugal pumps. It contains suggestions on the installation and operation of centrifugal pumps and numerous tables, including one showing head in feet and pressure in pounds, and another the friction of water in pipes. Attention is also called to the Taber automatic sump pump. The company is also distributing a folder covering the Taber midget sump pump for cellar drainage.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Basel, Switzerland (No. 20,579), for electrical appliances, such as electric irons and washing machines.

An agency is desired in Maracaibo, Venezuela (No. 20,519), for electrical equipment.

An agency is desired in Zurich, Switzerland (No. 20,494), for electric fans, small motors, transformers, regulators and dimmers, heating and cooking devices.

An agency is desired in Malta, Maltese Islands (No. 20,492), for electric lamps and wire.

A sole agency is desired in Quito, Ecuador (No. 20,585), for lighting sets for farms.

An agency is desired in Lille, France (No. 20,493), for meters and other measuring apparatus (steam, air).

Purchase is desired in Bagdad, Iraq (No. 20,584), of radio sets with six or eight tubes, with and without loud speakers, and also sets with batteries.

An agency is desired in Sydney, Australia (No. 20,482), for radio sets and parts.

Purchase or agency is desired in Arnhem, Netherlands (No. 20,489), for radio sets and parts.

Purchase and agency is desired in Leipzig, Germany (No. 20,490), for radio sets and parts.

An agency is desired in Munich, Germany (No. 20,491), for electrically-operated refrigerators.

Purchase is desired in Melbourne, Australia (No. 20,502), of automatic switching equipment.

Purchase is desired in Montevideo, Uruguay (No. 20,583), of 137,500 meters of rubber-covered wire.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BROCKTON, MASS. — Permission has been granted the Edison Electric Illuminating Company of Brockton to erect transmission lines from its plant at East Bridgewater to Pembroke and through East Bridgewater and Hanson, to connect with the lines of the Plymouth Electric Light Company.

BROCKTON, MASS.—The Edison Electric Company of Brockton has authorized Stone & Webster, Inc., 147 Milk Street, Boston, to double the transmission facilities from the Dupont Circle substation in Brockton to the lines of the Montaup Electric Company, Somerset, a distance of 14 miles. The line will operate at 66,000 volts. The work will include an extension to the switch house and the installation of a 7,500-kva. condenser.

CAMBRIDGE, MASS.—Plans has been filed by the Cambridge Electric Light Company for extensions in its power plant, including the installation of coal and ash-handling machinery, etc., to cost about $100,000.

LAWRENCE, MASS.—Plans have been prepared by the Lawrence Gas & Electric Company for the erection of a maintenance, repair and service building, etc., to cost about $75,000.

WALLINGFORD, CONN. — Plans are being considered by the Electric Light Department for the installation of new lamp standards on Hall and Quimipiac Avenues, Center, Colony and Elm Streets, to cost about $35,000.

Middle Atlantic States

BAYSIDE, N. Y.—Plans have been filed by the New York & Queens Electric Light & Power Company, Long Island City, for a substation on Bell Avenue, near Montauk Avenue. W. W. Knowles, Bridge Plaza, Long Island City, is architect.

BUFFALO, N. Y.—Plans for the proposed new flour mill to be erected by the Hecker-Jones-Jewell Milling Company, 503 Seneca Street, to cost about $400,000, include a power plant. The A. E. Baxter Engineering Company, Ellicott Square Building, is engineer.

CHAFEE, N. Y.—Plans for the rebuilding of the plant of the O'Dell & Eddy Company, recently destroyed by fire, with a loss of about $85,000, include a power plant.

CLIFTON, N. Y.—The Village Board is negotiating with the Rochester (N. Y.) Gas & Electric Corporation for the installation of an ornamental lighting system in the business district and for street lamps in the outlying sections.

ELMSFORD, N. Y. — Work will soon begin by the Westchester Lighting Company, Mount Vernon, on the construction of a local substation.

GOVERNORS ISLAND, N. Y.—Bids will be received by the Signal Corps Procurement District, Governors Island, until June 8, for transformers, brackets, switches, rheostats, etc.

JAMESTOWN, N. Y.—The City Council is considering the installation of ornamental lamps on portions of Severn Parkway, Lakeview and Arlington Avenues.

NEW YORK, N. Y.—An appropriation of $233,700 has been approved by the Board of Estimate for the purpose of installing a new system of traffic lighting for Manhattan, the Bronx, Brooklyn and Queens.

NIAGARA FALLS, N. Y. — The City Council has awarded a contract to William Young for the installation of an ornamental lamps on portions of Niagara, Twenty-fourth, Eleventh and Eighteenth Streets, Ontario and Erie Avenues, at $21,610.

OSWEGO, N. Y.—Work will soon begin on the construction of a new power house, 273 ft. long, 35 ft. wide and 40 ft. high, in connection with the proposed hydroelectric development of the Oswego River Power Corporation on the Varick Canal at Oswego. The equipment will include five 3,000-hp. turbo-generators, switchboards, etc.

THIELLS, N. Y.—Bids will be received by the Superintendent of Purchase, Capitol, Albany, until June 10, for heating work, service connections (tunnels, piping, etc.) and electric work, service connections (tunnel lighting), four cottages, and attendant's home (female infirm group) and hospital, Letchworth Village, Thiells.

PRINCETON, N. J.—A complete electrical laboratory, as well as mechanical engineering and hydraulic laboratories, will be installed in the proposed school of engineering to be erected at the Princeton University, to cost about $600,000. Day & Klauder, Franklin Bank Building, Philadelphia, are architects.

PHILADELPHIA, PA.—The Philadelphia Rapid Transit Company plans to build an automatic substation at the Sesqui-Centennial grounds.

UPPER MARLBORO, MD. — The Potomac Electric Power Company, Washington, D. C., has applied for permission to erect a transmission line between Forestville and Upper Marlboro.

CLARKSBURG, W. VA. — Steps have been taken by property owners and residents on Jackson Street for the installation of a new street-lighting system on that thoroughfare.

North Central States

DETROIT, MICH.—Bids will be received by the Public Lighting Commission until June 7 for heating and ventilating system, etc., for the new municipal electric plant. Smith, Hinchman & Grylls, 800 Marquette Building, are engineers.

DETROIT, MICH.—The Chevrolet Motor Company, a division of the General Motors Corporation, Detroit, plans to install electric power equipment in connection with porposed additions to its local gear and axle plant, and also in plants to be located at Bay City, and Toledo, Ohio. The cost of the entire work is estimated at $2,500,000.

YPSILANTI, MICH.—Plans are being prepared for a power plant at the Michigan Normal College, the erection to be carried out in conjunction with a proposed library building. An appropriation of $250,000, has been made for the two buildings.

BAYARD, OHIO. — The Ohio Public Service Company, Alliance, which is negotiating for the purchase of the property of the Bayard Electric Company, plans extensions in its transmission line to this vicinity.

SPRINGFIELD, OHIO.—Plans are being prepared by the Ohio Edison Company for the construction of a steam-operated electric plant on the Mad River, to cost with transmission system, about $1,600,000.

MURRAY, KY.—Plans are under way by the Kentucky-Tennessee Electric Power Company, Bowling Green, for the erection of a 33,000-volt transmission line from Mayfield to Murray, a distance of 22 miles, and for rebuilding the local distribution system.

EVANSVILLE, IND. — The Chicago & Eastern Illinois Railroad Company, Chicago, plans to install electric power equipment at its proposed local locomotive repair shops, to cost about $500,000.

CHICAGO, ILL.—The Crane Company, 836 South Michigan Avenue, plans to install electric power equipment in extensions to its plant at Forty-first Street and Kedzie Avenue, to cost about $450,000. Graham, Anderson, Probst & White, 80 East Jackson Boulevard, are architects.

SPRINGFIELD, ILL. — The Central Illinois Public Service Company has applied for authority to purchase the property of the New Holland (Ill.) Light & Power Company, and also to erect a transmission line from Sumner to Astoria.

VENICE, ILL.—Arrangements are being made by the Illinois Power & Light Corporation, Chicago, for the construction of a local steam-driven electric power plant to cost about $400,000. Extensions will be made in transmission lines.

BARABOO, WIS.—The Wisconsin Power & Light Company, Madison, plans to build a concrete dam, three feet higher than the present dam, and a new power plant.

JANESVILLE, WIS.—The City Council has accepted the proposal of the Wisconsin Power & Light Company, Madison, to install ornamental lamps in Riverside Park.

LA CROSSE, WIS.—Plans have been prepared by the Northern States Power Company, Eau Claire, for the erection of a transmission line from Indian Hill station to Grand Crossing, the station to be equipped with three new transformers. The company plans to install new street lamps to replace the ones now in use at a cost of about $25,000.

RACINE JUNCTION, WIS.—The installation of a new street-lighting system in the business district is under consideration by the Junction Business Men's Association.

SOLDIERS GROVE, WIS.—Plans are being prepared by the Interstate Power Company, 327 South La Salle Street, Chicago, for the construction of a hydro-electric plant in Soldiers Grove, to cost $75,000.

WAUTOMA, WIS.—Plans are under way by the Wisconsin Power & Light Company, Madison, to extend its transmission line from Wautoma to Silver Lake, to serve summer resorts in that district.

FARIBAULT, MINN.—Bids, it is understood, will be taken about June 1 for a power plant for the Faribault Woolen Mills, to cost about $50,000. Ralph W. Richardson, 301 Zenith Building, St. Paul, is engineer.

MINNEAPOLIS, MINN. — The public lighting committee of the City Council has approved the installation of new ornamental lamps on Hennepin and Nicollet Avenues, between the Great Northern Station and Twelfth Street, to cost about $65,000.

ST. PAUL, MINN.—The City Council has authorized the installation of street lamps on portions of Montreal Avenue, Snelling Avenue, Edgecombe Road and on Ford Road, to cost about $60,000. G. M. Shepard is city engineer.

ST. PAUL, MINN.—Contract has been awarded by Brown & Bigelow and the Quality Park Paper Box Company, Midway District, St. Paul and Minneapolis, to William Murphy & Son, 346 Endicott Building, for a 2,000-hp. power plant, to cost about $300,000. Toltz, King & Day, Inc., Builders Exchange, are engineers.

CLINTON, IOWA.—The local plant of the Interstate Power Company, 327 South La Salle Street, Chicago, was recently damaged by fire, causing a loss of about $4,000.

DENMARK, IOWA. — Frank Liddle, owner of the local electric plant, plans to erect a transmission line from Denmark to Augusta.

DES MOINES, IOWA.—Extensions are contemplated by the Des Moines Electric Company, including building a dam across the Des Moines River and an addition to power plant, to cost about $500,000.

FOLEY, MO. — Permission has been granted the East Missouri Power Company, Troy, to erect a transmission line from Winfield to Foley and to build an electric light and power distribution system in Foley.

HARVARD, NEB.—The Southern Nebraska Electric Company, Superior, which has acquired the local electric plant, plans to erect a transmission line from Clay Center, to establish a large auxiliary plant here, and also to change the local system from direct to alternating current.

Southern States

MOUNT AIRY, N. C.—Plans for the proposed mill to be erected by the Mount Airy Veneer Company include a power plant.

ROANOKE RAPIDS, N. C. — The Virginia Electric & Power Company, Richmond, which is erecting a high-tension transmission line through eastern North Carolina, has contracted with a number of municipalities, including Hollands, Boykins, and Newsom, Va., and with Seaboard, Edenton and Elizabeth City, N. C., to supply electrical energy. Under the contracts electricity will be sold in bulk to the municipalities and distributed by local systems.

CLAXTON, GA.—The municipal electric distribution system has been acquired by the Georgia Southern Power Company, Dublin, which plans to extend its transmission line here.

LUDOWICI, GA. — The Ware County Light & Power Company, Waycross, Ga., plans to erect a transmission line to Ludowici and vicinity, with extensions to Baxley and Nichols.

ORLANDO, FLA.—An election will be held June 8 to vote on the proposal to issue $1,500,000 in bonds, for municipal improvements of which $70,000 will be used for installation of a police and fire-alarm system.

BIRMINGHAM, ALA.—The City Commission plans to install an ornamental lighting system in the business district, to cost about $100,000.

LUVERNE, ALA. — The City Council plans to install ornamental lamps in the business district, covering about 10 blocks.

NATCHEZ, MISS.—The City Council is negotiating with the Southern Railway & Light Company for the installation of an ornamental lighting system in the business section, to cost about $25,000.

BATESVILLE, ARK. — The Batesville Portland Cement Company plans to install electric power equipment in its proposed mill, to cost about $1,000,000.

HOT SPRINGS, ARK.—Bids will be received by the constructing quartermaster, Hot Springs, until June 10, for construction of power plant, laundry building, etc., at Hot Springs Army & Navy General Hospital.

RUSTON, LA.—At an election to be held June 8 the proposal to issue $150,000 in bonds for extensions to the electric light and water plant and sewer system will be submitted to the voters.

BOISE CITY, OKLA. — Bonds to the amount of $30,000 have been authorized for the installation of an electric light and water plant.

ENID, OKLA.—The installation of an ornamental lighting system in the business district is under consideration.

HELENA, OKLA.—The properties of the United Power Company, which serves Helena, Medford, Jefferson, Hillsdale, Cremlin, Lahoma, Meno, Goltry, Nash and Jett, and agricultural section in Alfalfa, Grant and Garfield Counties, has been acquired by H. M. Byllesby & Company, Chicago, and will be operated by the Oklahoma Gas & Electric Company. These properties will be connected by a new high-tension transmission line of the Oklahoma company.

POTEAU, OKLA.—The City Council has had preliminary plans prepared for a 400-hp. electric light plant. The cost is estimated at $60,000. J. E. Davis, Poteau is engineer.

AMARILLO, TEX.—Plans are under consideration by the City Council for the installation of two new pumping plants in connection with extensions and improvements to the municipal waterworks, to cost about $850,000.

AVERY, TEX.—The Clarksville (Tex.) Public Utilities Company plans to erect a transmission line from Annona to Avery for light and power service. The line will also be extended to DeKalb and New Boston.

BRACKETTVILLE, TEX. — The local electric plant has been purchased by the Central Texas Central Power Company, San Antonio, which plans improvements and extensions to the system.

BRECKENRIDGE, TEX. — Steps have been taken by the Chamber of Commerce for the installation of an ornamental lighting system.

BROWNSVILLE, TEX.—Bids are being asked by the Public School Board for the construction of a power plant, to cost about $40,000. H. P. Smith, c/o National Bank of Commerce, San Antonio, is engineer.

FORT WORTH, TEX.—The Pacific Coal & Oil Company plans to install electric power equipment at its proposed local oil refinery, to cost about $400,000.

GOLIAD, TEX.—Plans are being prepared by the Texas Central Power Company, San Antonio, for the construction of an electric power plant in Goliad, to cost about $40,000.

MOULTON, TEX.—The property of the Moulton Light & Ice Company has been acquired by the Texas Central Power Company, which contemplates extensions to the system.

SEQUIN, TEX. — Extensions and improvements to the municipal electric plant are under consideration by the City Council.

Pacific and Mountain States

OAK GROVE, ORE. — The Portland (Ore.) Electric Power Company has applied to the Federal Power Commission for permission to make extensions to its local power plant, to cost about $3,000,000. The work will include the construction of a 4-mile tunnel betwen two forks of the Clackmas River and enlarging the reservoir capacity.

LOS ANGELES, CAL.—The City Council has authorized the installation of ornamental lamps on portions of Sierra Bonita, Curson, Spaulding and Stanley Avenues, Gardner, Genessee and Eleventh Streets.

PALO ALTO, CAL.—Separate bids will be received by the United States Veterans Bureau, Room 791, Arlington Building, Washington, D. C., until June 21 for construction of new buildings and construction and repairs to existing buildings, plumbing, heating, electrical work and electric elevator, at the United States Veterans' Hospital No. 24, Palo Alto.

SAN FRANCISCO, CAL.—The Finance Committee of the Board of Supply is considering an appropriation of $150,000, for the installation of traffic-signal systems in different parts of the city.

SAN FRANCISCO, CAL. — Permission has been granted the Eldorado Power Company, San Francisco, to construct a hydro-electric power plant on Silver Fork Creek, Eldorado County, to develop 122,560 hp. The project will include a transmission line.

SAN LEANDRO, CAL. — The Board of City Trustees is considering the installation of an improved electric fire-alarm system.

STOCKTON, CAL. — Permission has been granted the Western States Gas & Electric Company to use water from Silver Creek, Eldorado County, for a proposed hydro-electric power project to develop 28,000 hp.

UPLAND, CAL. — The City Council is considering the installation of ornamental lamps on Second Avenue, from C to Twelfth Streets.

OGDEN, UTAH.—The City Council has entered into a new contract with the Utah Power & Light Company, Salt Lake City, whereby the street-lighting service will be greatly increased in both the business and residential sections. Under the new contract all arc lamps, except in the business district, will be replaced with incandescent lamps.

GLENDIVE, MONT.—The Montana-Dakota Power Company plans to increase the output of its power plant and to erect a transmission line from Culbertson to Plentywood, a distance of about 60 miles.

MILES CITY, MONT.—The City Council has engaged the Burns & McDonnell Engineering Company, Interstate Building, Kansas City, Mo., to prepare plans for extensions to the municipal electric plant.

CANON CITY, COLO.—The City Council contemplates the installation of an improved lighting system on Main Street. George S. Cowdery is engineer.

CREEDE, COLO.—Bids will be received by the City Council until June 5, for the construction of a municipal hydro-electric plant. The Weiland Engineering Company, Thatcher Building, Pueblo, is engineer.

Canada

CHELSEA, QUE.—The Canadian International Paper Company, which originally planned to install four units at the Chelsea and Farmers' Rapids power plants, has decided to add another unit to each power house, which will increase the output of the two plants by 58,000 hp. The electric generating capacity of the Kippawa mills will be increased from 8,000 hp. to 24,000 hp.

HUNTINGDON, QUE.—Permission has been granted the Huntingdon Electric Power Company to erect a 3,200-volt transmission line from White Station to St. Anticet, a distance of 17 miles.

LIMOILAN, QUE. — Bids, it is understood, will soon be asked by the Quebec Power Company for construction of repair and car construction shops, to cost about $500,000.

SHAWINIGAN FALLS, QUE.—Permission has been granted to the Electric Service Corporation, a subsidiary of the Shawinigan Water & Power Company, to erect a transmission line between Chaudieres and Deschaillons.

Electrical Patents

Announced by U. S. Patent Office

(Issued April 28, 1926)

1,582,141. ELECTRICAL RESISTANCE MATERIAL; J. S. Nowotny, Cincinnati, Ohio. App. filed June 13, 1921. Process of forming a resistance element material, consisting of mixing in selected proportions a very high, a medium and a very low resistance material and then subjecting them to heat and blending them into a substantially homogeneous composition, then mixing the material with different proportions of relatively medium and low resistance materials and uniting them by ceramic treatments.

1,582,145. LIGHTER; M. H. Shoenberg and L. Schon, San Francisco, Cal. App. filed July 17, 1924. For cigars, cigarettes or pipes.

1,582,154. PRESSURE-CONTROLLED INDICATOR FOR MOTORS; A. Zeiher and J. E. Zeiher, Seattle, Wash. App. filed Jan. 7, 1925. Especially adapted for use in connection with a pump-operated oil-pressure system to give warning when the oil pressure fails.

1,582,215. ELECTRIC SWITCH FUSE; R. W. Gregory, Hexham-on-Tyne, England. App. filed March 6, 1923. Of the type intended for use on high-voltage systems, such switch fuses usually being ironclad and operating under oil.

1,582,222. DEVICE FOR MEASURING VALUES OF RESISTANCE OF CABLES AND CONDUCTORS; V. Planer, Berlin-Lankwitz, Germany. App. filed Nov. 27, 1922. Employing the principle of the Wheatstone bridge.

1,582,269. ELECTRICAL WELDING MACHINE; A. Z. Johnson, and N. A. Johnson, Jamestown, N. Y. App. filed Jan. 23, 1924. Method of butt-welding steel tubing electrically at high speed, with a minimum consumption and loss of current, and a machine for carrying out such method.

1,582,287. OUTLET-BOX SUPPORT; D. Luckwaldt, S. L. Katz and F. Grossman, Chicago, Ill. App. filed June 21, 1922.

1,582,290. ELECTRICALLY HEATED BREAKFAST SET; J. R. Marchesseault, Cranston, R. I. App. filed April 27, 1925. Portable service tray equipped to receive removably a plurality of electrically heated cooking utensils composing the set, such as coffeepot, teapot, toaster, waffle iron, etc.

1,582,330. LIGHTNING-ARRESTER CONSTRUCTION; L. S. Brach, East Orange, N. J. App. filed May 17, 1919. For the protection of low-voltage apparatus.

1,582,376. SWITCH FOR ELECTRIC CIRCUITS; V. Breeze, Brighton, England. App. filed June 1, 1922. Of the push-button type; of simple construction applicable for use with inductive currents and wherein the injurious effects of arcing are prevented or reduced to a minimum.

1,582,427. DYNAMO-ELECTRIC MACHINERY; C. A. Parsons and J. Rosen, Newcastle-on-Tyne, England. App. filed Dec. 19, 1923. A construction of alternator or the like which can safely generate currents of higher voltages than are now usual while keeping the size and weight of the machine comparatively low. A winding for electrical apparatus, comprising in combination a pluarity of conductors nested one within the other carrying voltages stepped down from within outward, layers of insulating material between and around said conductors, means for connecting said conductors in series and means connecting one end of the outermost conductor to a neutral point, as set forth.

1,582,497. FORMS OF ALTERNATING-CURRENT ARC-WELDING APPARATUS; C. B. Waters, Montclair, N. J. App. filed Feb. 4, 1924. Having a straight open-core arrangement and with the secondary current supply regulated in a number of ways.

1,582,549. ELECTRIC WELDING MACHINE; F. L. Sessions, Lakewood, Ohio. App. filed April 1, 1922. For progressively welding a longitudinal butted seam in metal tubing.

1,582,567. ELECTRODE; V. Yngve, Long Branch, N. J. App. filed July 30, 1923. Metallic electrode for dry cells. An electrode which will not be corroded locally before being placed in actual service.

1,582,609. PLUG CONNECTOR; L. E. Isele, Verona, N. J. App. filed March 23, 1923.

1,582,640. CASING FOR ELECTRIC MOTORS; H. Dalton, Stamford, Conn. App. filed March 13, 1925. To provide a suitable casing for the power transmission gearing connected with one end of the motor shaft and which is adapted to be detachably fixed to the casing proper for the motor and is provided with a substantially oil-tight chamber inclosing parts of the transmission gearing.

1,582,649. ELECTRIC LIGHTING FIXTURE; E. A. Gillinder, Philadelphia, Pa. App. filed July 23, 1924.

1,582,658. SATURATION COMPENSATION FOR METERS; D. J. Angus, Indianapolis, Ind. App. filed May 26, 1922. A magnetic shunt is provided across the poles of the magnet to be compensated, in parallel to the magnetic path which actuates the meter element, and this shunt is arranged so that it approaches saturation sooner than does the actuating magnetic path and the remainder of the magnetic circuit; so that at low energization this magnetic shunt carries a fairly large part of the flux and thus diverts it from the actuating path, but as the energization increases the shunt approaches saturation and forces a larger proportion of the total flux through the actuating magnetic path.

1,582,671. PROTECTED WELDING CIRCUITS; O. H. Eschholz, Pittsburgh, Pa. Used in connection with street-railway work; protects the operator from the relatively high voltages employed in the supply circuit.

1,582,678. RELAY; W. C. Goodwin, Pittsburgh, Pa. App. filed Nov. 11, 1919. Reverse-phase protective device.

1,582,684. ELECTRIC HEATER FOR STREET CARS AND THE LIKE; W. G. Hartwig, Chicago, Ill. App. filed April 26, 1924.

1,582,687. DRY CELL; W. Ramsay, Westfield, N. J. App. filed March 24, 1924. Lining or separator for dry cells.

1,582,691. TERMINAL CONNECTION FOR ELECTRODES; E. J. Reich, Brooklyn, N. Y. App. filed July 30, 1923. Of dry cells.

1,582,699. ELECTRICAL MEASURING INSTRUMENT; B. H. Smith, Wilkinsburg, Pa. App. filed Feb. 19, 1921. Direct-current watt-hour meter utilizing a current shunt.

1,582,702. APPARATUS FOR CONTROLLING ELECTRICAL AND OTHER OPERATING CONDITIONS OF ELECTRIC CIRCUITS; E. R. Stoekle and A. Simon, Milwaukee, Wis. App. filed July 20, 1923. A device for controlling the operating condition of an electric circuit, comprising means for deflecting a beam of light to a degree corresponding to the deviation of the operating condition of the circuit from a standard condition and means for subjecting the circuits to control in accordance with the value of such deflection.

1,582,708. BATTERY-CHARGING SYSTEM; L. C. Vaughn, Wilkinsburg, Pa. App. filed March 30, 1921. Whereby a number of batteries may be charged simultaneously and each battery disconnected independently as its charge is completed.

1,582,709. ELECTRIC RADIANT HEATER; V. G. Vaughn, Wilkinsburg, Pa. App. filed May 24, 1923.

1,582,711. ELECTRIC SWITCH; F. G. von Hoorn, Brooklyn, N. Y. App. filed May 10, 1922. Manually operable means for closing a switch that is provided with an overload device, in such manner that if an overload is present at the time the switch is moved to closed position, the switch may be automatically released regardless of the position of the manually operable member.

1,582,712. CURRENT-COLLECTING DEVICE; C. F. Wagner, Pittsburgh, Pa. App. filed July 5, 1922. Current-equalizing means for brush-holder stands.

1,582,755. ELECTRIC BRAKING MECHANISM; H. V. James, Radlett, England. App. filed Dec. 17, 1924. Method of applying the brakes of machines, particularly referring to multiple-unit machines, such as printing, paper-making and textile machines of which the rotating parts must be stopped simultaneously and for which a number of brakes are provided at various positions on the machine for the purpose.

1,582,825. CONTROL SYSTEM; L. D. Kellogg, Deerfield, Ill. App. filed Nov. 10, 1921. For a combined water-supply and storage-battery-charging-control system for automatically maintaining the pressure of the water supply within certain limits and also for maintaining the voltage of the storage batteries within certain predetermined limits.

1,582,828. TERMINAL CLIP; D. K. Kuskin, New York, N. Y. App. filed March 27, 1924.

1,582,849. QUARTZ LAMP; K. Mensing, Hanau-on-the-Main, Germany. App. filed Aug. 24, 1921.

1,582,850. BUSBAR STRUCTURE; D. F. Miner, Wilkinsburg, Pa. App. filed Sept. 24, 1920. Means for balancing or equalizing the currents in parallel-related conductors.

1,582,853. AUTOMATIC STATION; W. L. Newmeyer, Wilkinsburg, Pa. App. filed Feb. 18, 1924. Protective devices to be utilized in the starting and the operation of the apparatus in automatic stations.

(Issued May 4, 1926)

1,582,957. ELECTRICAL RECEPTACLE; C. E. Avery, East Orange, N. J. App. filed Dec. 2, 1922. To accommodate two separate plugs either of the tandem or parallel-blade type.

1,582,986. ALTERNATING-CURRENT ELECTROMAGNET; P. F. Harris, South Shields, England. App. filed April 9, 1924. One or both of the surfaces of the co-operating magnetic members is formed with one or more points, ridges or small area surfaces, which, while making magnetic contact with the co-operating surface, prevent the two main surfaces from touching over their main areas.

1,582,987. REMOTE-CONTROL ELECTRIC SWITCH; G. W. Hart, West Hartford, Conn. App. filed Dec. 6, 1924. Having an opening coil and a closing coil whose axes are in alignment with one another and having means for locally interrupting the circuit of each coil after it has performed its intended function; also means for causing the switch to open and close the controlling units locally and means for adjusting the throw of the switch arm.

1,583,021. BATTERY CELL; A. H. Snyder, Lancaster, N. Y. App. filed Aug. 10, 1918. Of the submarine type.

1,583,057. CUT-OUT PANEL; W. J. Lang, Cicero, Ill. App. filed Oct. 20, 1924. Permitting the use of two independent terminals for each fuse receptacle.

1,583,169. COATED WELDING ROD; H. R. Pennington, Chicago, Ill. App. filed May 3, 1922. Used in electric arc welding, where the rod forms one terminal of the arc and is fused or welded onto a body of metal called the base metal.

1,583,190. TIME-CONTROLLED AUTOMATIC SWITCH; R. D. Shafer, Pleasanton, Cal. App. filed Feb. 20, 1923. For application to a clock which will automatically open and close a plurality of switches at any predetermined interval of time; designed to switch on and off lights where it is not desired to burn them continuously.

1,583,207. CLIPPERS; L. J. Wahl, Sterling, Ill. App. filed Feb. 4, 1924. For use in barber shops or other places.

1,583,210. ELECTRIC LIGHTING SYSTEM; W. C. Wefel, Denver, Col. App. filed March 19, 1923. For automatically regulating the current flow in electric lighting circuits. Its primary object is to provide in a circuit of this character an electric magnetic appliance which by the temporary inclusion of a supplemental coil in the course of current flow renders said flow equable from the moment the circuit is completed. For use in a series electric lighting circuit in which, in the event of an interruption in the current flow in any lamp unit by breakage of the lamp filament or other similar cause, a resistance substantially equivalent to that produced in the lamp is automatically connected in the circuit.

1,583,247. STORAGE-BATTERY BOX; L. A. Doughty, Glenside, Pa. App. filed Nov. 25, 1924.

1,583,266. FUSE PLUG; M. E. Winks, San Jose, Cal. App. filed Jan. 6, 1921. Renewable.

1,583,313. ATTACHMENT PLUG; W. P. Robertson, New York, N. Y. App. filed Sept. 30, 1921. May be readily attached to the usual socket or other connecting device without the necessity of twisting the plug, whereby twisting of the conductor attached to the plug is avoided.

1,583,361. AUTOMATIC REGULATOR; J. S. O'Hara, Romney, W. Va. App. filed Feb. 5, 1924. Mechanism for the automatic regulation of power in any form by mechanism set in action by the closing of a high-voltage circuit by means of the pointer or indicator of a measuring instrument.

1,583,369. IRONING SHOE; C. E. Reddig, Kew Garden, N. Y. App. filed June 30, 1924. For power-driven ironing machines.

1,583,383. OIL-COOLED TRANSFORMER; R. V. Bingay, Pittsburgh, Pa. App. filed June 2, 1920. Tank formed of sheet steel with the corrugations of the tank body of any desired depth and strength required by practice, and at the same time the corrugations are formed from sheet-metal plates in a simple and inexpensive manner. The resultant structure is strong and self-sustaining and when assembled with the top and bottom portions provides a rigid durable container. Method of relatively supporting the transformer and tank.